CHAPTER 1: INTRODUCTION

My study explores relevance and reliability criteria applied to information by secondary students in an Australian school. In the 1990s, 'credibility' began to feature in information science literature (Rieh & Danielson 2007), whereas the prime criterion for selection of information was earlier considered its relevance to the user's information need. My investigation focuses on the strategies used by students to learn from information. The study is contextualised by information search tasks set by teachers to encourage the development of independent research and learning skills. Sormunen and Lehtiö (2011) refer to such tasks as source-based writing tasks. The tasks undertaken by participants are in a range of curriculum areas, including Humanities subjects (particularly History), Science and Music. While each task is domain-specific, the study's results are anticipated to reveal common approaches across the various domains. Students were not given formal instruction related specifically to the information search tasks set for them to do; this study, therefore, is explicitly excluded from those studies that examine the effectiveness of an educational intervention. Instead, it investigates how students respond spontaneously to information search tasks. In earlier years of schooling, however, some formal guidance in approaching such tasks has been provided, making it likely that some learning from prior experiences has been transferred to the tasks examined in my investigation. The sociocultural context of the school, with its expectations of teachers and the curriculum through which such tasks are presented, plays a dominant role in students' approach to information search and usage activities. The literatures of both library and information science (LIS) and cognitive psychology, particularly decision making theory, provide the theoretical framework of my study.

The use of Web-based information has become commonplace in our schools and universities, with information searches generally beginning with search engines, the most popular of which is *Google* (Rieger 2009). The use of search engines has become an everyday experience, with the attendant risk that the process of searching for information has become 'a routine without questioning the quality of information found' (Rieger 2009: online). People face uncertainty about the credibility of information they encounter (Rieh & Danielson 2007). There is widespread concern, particularly among educators, about the trustworthiness of Web information (Fallis 2006; Metzger 2007), with some of this concern centred on the accuracy of information in *Wikipedia* (Lim 2009). Without controls on the production of websites

and the publication of information on them, the burden of judging credibility falls on the consumer (Robins, Holmes & Stansbury 2010). User-created and collaborative resources strain students' ability to assess credibility (Sundin & Francke 2009). Fitzgerald (2005) believes that educators should teach students about unreliable information. Modern life requires effective information seeking skills, and the abilities to 'choose relevant resources and judge information critically' (Heinström 2002:2).

Albion (2007) suggests that, despite confidence in their skills in finding information on the Internet, students in their first year of university do not demonstrate corresponding levels of competence. Gil and Artz (2006:573) identify the need to understand the 'critical capability' of making trust decisions when interacting with open information sources such as those on the Internet. Kim (2010), also concerned about the credibility of information on the Internet, looked at the particular challenges posed by social media, where traditional tests of expertise, such the affiliation of the author, are more difficult to apply. Similarly, Candy (2004:192) writes of 'the difficulty of discerning relevant from irrelevant, credible from unbelievable and reliable from unreliable knowledge claims and sources'. Such discernment is more challenging in the Web environment than when examining the products of traditional print publishing, with which we associate gatekeepers who ensure that 'only those with enough authority and capital to justify and sell an information product' are permitted to incur the 'substantial costs of information production and dissemination on a mass scale' (Metzger 2007:2078). Rieh and Danielson (2007) also make the point that the traditional professional knowledge workers of the print environment do not have an equivalent in the online world to maintain a watch on the credibility of information. In the Web environment, new information evaluation skills are required. Easy access to large volumes of information that can readily be copied and pasted has also led to concerns about plagiarism, the indiscriminate use of Web information (that is, without reflecting on its quality) and over-dependence on the medium (McGuinness & Brien 2007; Nicholas, Huntington, Jamali, Rowlands & Fieldhouse 2009; Williamson & McGregor 2006). It is, therefore, appropriate to investigate the judgements of relevance and reliability made by students within the context of a learning task in which students depend on Web-based information. As relevance judgements generally precede reliability judgements, it is important to study the latter in the light of the former. The current study is, however, not restricted exclusively to Internet-based information sources and includes references to participants' experiences of what Wilks (2008:10) reports having heard labelled 'off-computer research' to mean 'research using resources other than computers'.

Since 2000, the Center for the Digital Future, based at the University of Southern California's Annenberg School for Communication and Journalism has been 'conducting a long-term longitudinal study on the impact over time of computers, the Internet and related technologies on families and society' (University of Southern California. Annenberg School for Communication & Journalism. Center for the Digital Future 2011:online). The Center's tenth study reports that 40% of respondents in North America, South America, Europe, Asia, the Middle East, and Australasia considered most or all of the information on the Internet to be reliable (*ibid*.). This is a more optimistic view than reported in their ninth report, which found that 40% or more people in the ten reporting countries considered only half or less of the information on the Internet to be reliable (University of Southern California. Annenberg School for Communication & Journalism 2010). The 2010 report found that the Internet features prominently as a source of information for students completing school-related tasks: more than two-thirds of students accessed it at least weekly while 30% went online on a daily basis looking for information for their school work. The 2011 report found that respondents under 18 said that the Internet had 'some level of importance for their schoolwork, while only four per cent said the Internet was not at all important' (University of Southern California. Annenberg School for Communication & Journalism 2011:online). Asked about the academic impact of the Internet, a considerable proportion of parents (84%) claimed that their children's grades had remained the same or declined. The 2011 report (*ibid.*) also surveyed attitudes about the reliability and accuracy of five categories of website (see Table 1.1).

Site type/provider	***Information considered reliable and accurate***	***% respondents***
Government	Most or all of the information	79
Established media websites		75
Search engines		50
Individuals		15
Social networking sites	A small portion or none of the information	51

Table 1.1: Respondent views on information reliability and accuracy by site type/provider (University of Southern California. Annenberg School for Communication & Journalism 2011)

My literature review (see Chapter 2) shows that, although relevance and reliability criteria have been investigated, studies have tended to be of tertiary students (graduate and undergraduate) and adults. The current study intends to complement our understanding of such phenomena by investigating a group of secondary school students. The literature review also reveals that the information search process (ISP) of secondary, or high school students, is an understudied area. Taylor, Zhang and Amadio (2009:722) define ISP quite simply: the behaviour of the individual 'from when the user recognizes their information need to the conclusion of their efforts to resolve that information need'. Kuhlthau (1991:361) defines ISP as 'the user's constructive activity of finding meaning from information in order to extend his or her state of knowledge on a particular problem or topic'. In the few studies of students' ISP, relevance and reliability criteria have rarely been explicit emphases. By examining the learning strategies of academically successful students, effective approaches to information sources that are used in a naturalistic setting will become apparent. Such strategies may then inform the approach of teachers and teacher librarians who wish to assist other students to achieve academic success (see also Section 5.8). (I use 'teacher librarian' synonymously with 'school library media specialist' and 'school librarian' but distinctively from 'librarian' in other contexts, such as a public library.)

The research reported here was prompted by my conviction that evaluation of information by students by means of a checklist of criteria was so laborious and lacking in spontaneity that they would not apply such an approach. I had observed students listening politely when offered such checklists and being invited to apply them; however, unless the assessment task explicitly required evidence of the application of such a checklist, they did not use it. Decisions about which information sources to use appeared to be made on much more pragmatic grounds; and expecting students to report on rejected sources seemed particularly futile, considering that such sources were not used, and writing up the case for their rejection was rightly seen as preventing progress towards completion of the broader task.

In the remainder of this chapter, I situate my study in the field of *information behaviour*, and consider definitions of *information*, before discussing the particular situation of information behaviour in schools. I then proceed to outline the role of context in information behaviour, looking specifically at the role of task in the learning context. The remainder of the chapter considers concepts drawn from the literature of information behaviour; it is distinct from the literature review in Chapter 2, which focuses on the findings in reports of research studies in the field of information behaviour.

In the section following, I group the constructs of *relevance* and *reliability* in information science under the category of information evaluation. Subsequently, I present an overview of decision making theory, focusing on naturalistic decision making, and its associated consideration of heuristics.

1.1 Information behaviour

Central to the conceptual framework of my study is the making of meaning, that is, the student's attempt to build meaning from the information that he or she encounters. When making meaning, the student engages in information behaviour that includes *information seeking*, *information searching* and *information retrieval*. *Information behaviour* encompasses 'those activities a person may engage in when identifying their own needs for information, searching for such information in any way, and using or transferring that information' (Wilson 1999:249). Other terms for 'information behaviour' include 'information practices' and 'information activities'. Courtright (2007:274) finds consensus in the literature that information seeking is a process that is 'iterative and variable over time and context'.

In Wilson's (1999) information behaviour model of 1981, an individual perceives an *information need*, which motivates information seeking behaviour. Xu, Tan and Yang (2006:1670) define an information need as 'the demand of a specific task or problem situation'. Shenton and Dixon's (2003b:8) more detailed definition portrays an information need as requiring a response: 'the desire or necessity to acquire the intellectual material required by a person to ease, resolve or otherwise address a situation arising in his or her life'. An information need may be further elaborated as 'the desire or necessity to acquire, in order to meet a purpose, facts, interpretations, advice, opinions or other forms of messages carrying meaning' (Shenton & Dixon 2003a:1032). An individual's information need is important in understanding relevance, considering that information sources are judged, subjectively, for the degree of their relation to the individual's information need (Xu & Yin 2008). The centrality of information need is reflected in most models of information behaviour, as is the context that motivates such behaviour (Todd 2003), which will be discussed in Section 1.3. Wilson (2006:664), a reprint of Wilson (1981), advocates that 'information needs' be replaced by 'information seeking towards the action of needs'; however, this has not been widely adopted, despite its accurate location of information needs within information seeking. Courtright's (2007) literature review notes that about 8% of library and information science studies were of information needs, seeking, and use (INSU). In the school context, the information need is imposed by the teacher. The present investigation seeks to elucidate the relationship between INSU and learning in the school setting by focusing on the criteria used by secondary school students to judge the relevance and reliability of information.

Initially, a distinction between *information seeking* and *information searching* as aspects of information behaviour appears overly subtle; however, the former is used to refer to the totality of all information behaviour, while the latter describes the interaction between an individual and an information system (Tanni & Sormunen 2008). Likewise, Wilson (1999) views information searching as a subset of information seeking, which, in turn, is a subset of information behaviour (see Figure 1.1).

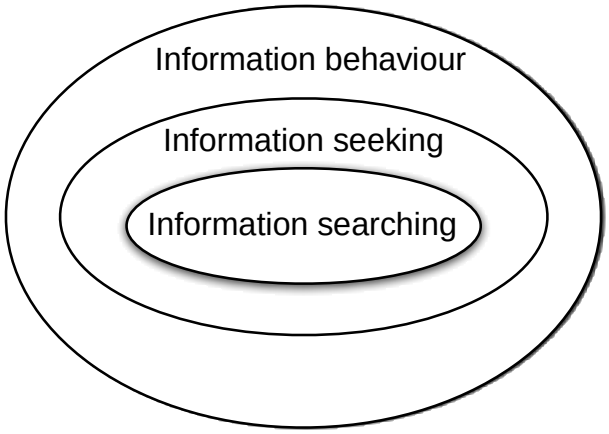


Figure 1.1: Wilson's (1999) nested model of information behaviour

Information retrieval (IR) refers to the retrieval of information from the system, and, during IR, the user makes relevance and reliability judgements that are subjective. Research oriented to the user and a subjective perspective of what constitutes relevance is now more common and is, in part, a reaction to the inadequacy of explanations developed by studying relevance from a systems perspective (Xu & Chen 2006). Ruthven (2005:64) notes recent attempts by designers of information retrieval systems to use metadata to assist the user to make relevance judgements; however, he claims, the more objective data about information sources, such as 'authorship, date, and content information', are the typical metadata elements provided, and these do not address the more subjective, user-based assessments, such as 'information quality, reliability and novelty'. The conceptual framework of my study is sketched in Figure 1.2 below. Judgements of the relevance and reliability of information are evaluations of information quality and, as Fitzgerald (2005:3-4) demonstrates, 'effective evaluation may not be possible without at least some thinking about one's own thinking', thus requiring what is popularly called metacognition.

Fitzgerald (2005) points to the use of procedural knowledge that, applied to the evaluation process, has been built up during past thinking episodes, and the employment of metacognitive regulation in the conscious choice of strategies in the evaluation process. I agree with Fitzgerald (2005:4) that 'Simply recognizing the need to evaluate information is probably a metacognitive event' on the part of the user. I have thus included metacognition in Figure 1.2 to indicate its role in relevance and reliability judgements made when making meaning of information. Metacognition, in turn, is related to decision theory through the mental models that form part of procedural knowledge.

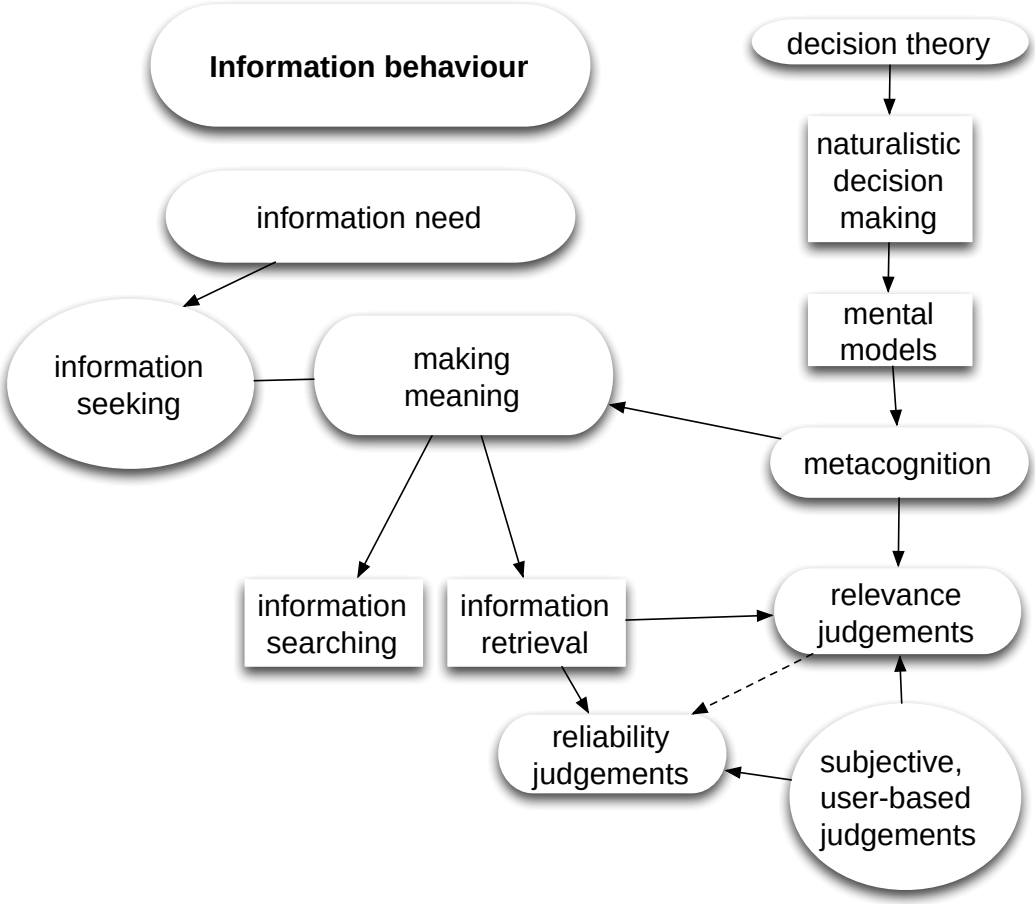


Figure 1.2: Conceptual framework of current study

The individual seeks information, which may or may not result in finding relevant information that satisfies the individual's information need. If the found information does not satisfy the need, the search process must be repeated (Wilson 1999). Wilson's 1996 model of information behaviour incorporated knowledge from fields such as 'decision making, psychology, innovation, health communication, and consumer research' (Wilson 1999:256). It included intervening variables that may help or hinder information use, grouping them as: psychological, demographic, role-related or interpersonal, environmental, and source characteristics. The model also incorporated the following types of information behaviour: passive attention, passive search, active search, and ongoing search. The 1996 model, furthermore, drew on three theories for hypotheses of activating mechanisms: stress/coping theory, risk/reward theory, and social learning theory (Wilson 1999).

Fisher and Julien (2009:14) observe rising interest in the information behaviour of 'non-elite or special populations', that is, the information behaviour of people in everyday settings, including students in a school setting. My investigation uses data gathered from slices of actual learning episodes of secondary school students. Such an approach maintains the context of real-life student experience, with the recording of such episodes intended to avoid the problems associated with self-report data. Muis (2008:179), for example, warns that 'students may answer self-report items by constructing an answer grounded in a schema rather than by retrieving facts about events'. Hofer (2004:44) also contends that the use of think-aloud protocols to investigate students' thought processes during online searching permits the investigation of 'personal epistemology not as a decontextualized set of beliefs, but as an activated, situated aspect of cognition that influences the knowledge building process'. As opposed to using a contrived search task, the information use-in-context approach is more likely to reveal the full, rich repertoire of learning strategies (subsequently defined) displayed in a natural setting. Teachers will relate more readily to the familiar, naturalistic setting than to a laboratory setting. Corrigan (2001:40) points out, 'An understanding of learners' decisions about processes and their metacognitive applications may … have implications for teaching and the skills required to support effective learning'. He adds that accurate description of 'the manner in which learners undertake open-ended investigations and the manner in which processes relate to each other informs our understanding of learning' (2001:40). Ford's (2004:192) definition of a learning strategy is apposite here: 'a particular way of processing information in relation to a learning task'; such

processing may entail ‘rehearsal, elaboration, organization, critical thinking, and metacognitive-regulation’ (Lynch 2006:424). Students’ decisions in relation to which sources of information to use form part of their learning strategies, and judgements of an information source’s relevance and reliability play a major part in whether students decide to use a source or not.

Case’s (2006) literature review concludes that information behaviour studies are popular, with researchers attempting to find out what is going on in the mind of the seeker. Case (2006:314) credits Dervin as beginning a trend to ‘various strains of the “sense-making” paradigm as well as constructivist and constructionist models of thought’; here, constructionism refers to the essentially philosophical view of how we construct meaning, while constructivist teaching refers to a teaching approach informed by constructionism. The outcome has been that ‘the dynamic, personal, and context-laden nature of information behavior seems to be taken as a given by all’ (Case *ibid.).* Sense-making is defined as ‘behavior, both internal (i.e. cognitive) and external (i.e. procedural), which allows the individual to construct and design his/her movement through time-space’ (Ingwersen & Järvelin 2005:60). Case expresses concern that, in portraying almost any use of the Web as a type of information seeking behaviour, we have broadened the notion of *information behaviour*, losing the distinction that *online searching* once offered. While my study did not set out to focus on online searching exclusively, Francke, Sundin and Limberg (2011) observe that students will use those tools that are available to them. The current information universe of students offers online tools that are simple and convenient to use; inevitably, online searching will constitute a major proportion of their information behaviour.

Case (2006) notes an apparent trend in the literature to consider online searching to be subsumed under the more general notion of information behaviour, so that Web studies are more commonly considered studies of information seeking, that is, ‘any action taken by an individual in response to a perceived need’ (Shenton & Dixon 2003b:7), or the similar ‘purposive seeking of information to satisfy an information need’, whose authors assume the active nature of the behaviour (Xu, Tan & Yang 2006:1667). Spink and Cole (2006:26) conceptualise information seeking as ‘a subset of information behavior that includes the purposive seeking of information in relation to a goal’. The current study follows this

trend; though largely focused on students' use of Web sources, it also considers other sources, notably printed books; thus, it is more appropriate to situate the study in the broader notion of information behaviour.

Tanni and Sormunen (2008:907) developed the Integrated Information Seeking and Retrieval (IS&R) Research Framework, 'a task-based perspective on the IS&R research related to information behavior in learning tasks'. The literature for their framework showed patterns of information seeking that were similar to each other but examined from different perspectives. The framework, simplified in Figure 1.3, is important for showing 'characteristics of and relationships between the learner, the learning task, and the access and interaction research dimensions' (2008:907). Tanni and Sormunen (2008) include the following among learning task dimensions: learning environment; learning assignment; learning and documentation process; and task output and learning outcomes. Information seeking and document selection were included under their heading of access and interaction dimensions. Their learner dimensions encompassed the following: cognitive mental states, affective mental states, and learning styles. Tanni and Sormunen's (2008) literature review concludes with the recommendation that integration of research frameworks is preferable to researchers developing yet more models and terms. Their paper is a rare synthesis of the influences on the information behaviour of a learner engaged in a learning task.

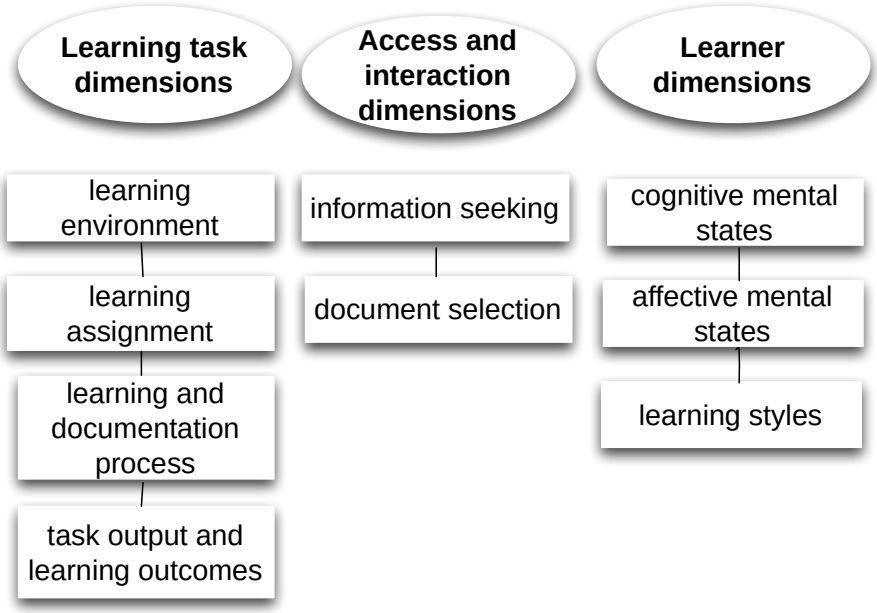


Figure 1.3: Tanni and Sormunen's (2008) research dimensions (simplified)

1.1.1 Defining 'information'

My study emerges from a perspective of the user as an 'active, constructive person'; the study acknowledges an individual, subjective view of information where 'information is the sense or internal knowing a person constructs to fill an information gap'; and recognises the 'unique psychological, sociological, cognitive factors that shape information seeking and use' (Todd 2003:29). This view of information is consistent with that of Hjørland (2000b:32), in which, rather than 'being physical units like documents or intangible units like decontextualised pieces of facts, opinion or ideas', information is seen as 'a change in the receiver's knowledge'. Tanni and Sormunen (2008:895) distinguish between information from the respective perspectives of author and interpreter: (a) information may be the 'the result of a transformation of the author's knowledge structures into information objects', thus equating it with Hjørland's (2000b) physical units; (b) information may be 'something which, when perceived and interpreted, affects and transforms the interpreter's state of knowledge', similarly to Hjørland's intangible units. My report refers to 'information sources' when referring to physical units.

Another definition of information, but with less emphasis on cognition, is 'ideas or thoughts that individuals contribute, seek, or obtain from formal or informal discussion, investigation, or study' (Dresang 2005:179). A personal interaction with the information problem is important in the motivation of the user and appears to influence the user's ability to construct knowledge successfully (McGregor 1995). Miller (n.d.:2), contrasting information ('existing data that can simply be obtained through search') with knowledge (which he sees as resulting from a 'cognitive learning process'), underlines the interaction of the individual with information in order to build knowledge. The current investigation is thus aligned with the metatheory of constructionism and focuses on the cognitive viewpoint of participating students or, as articulated by Talja, Tuominen and Savolainen (2005:81), 'the way in which knowledge is actively built up by the cognising subject, that is, by the individual mind to serve the organisation of internal and external reality'.

Frické's (2009:133) definition of information, somewhat narrower than that of Ford (2008; see Section 1.3.1), assumes the phenomenon to be data until an interaction with the user has begun: 'relevant, or usable, or significant, or meaningful, or processed, data'.

My interest is in how the individual decides that the information (or, in Frické's view, data) is relevant and reliable. For Frické, the processing, or transformation, of the data turns it into information, thus indicating a functional, rather than structural, difference between data and information. In Frické's view, the raising of a question directs the search for information; this equates to the identification of an information need on the part of the seeker. Higgins's (1999:132) definition of information is perhaps a useful compromise: 'data which presents a recognizable pattern of meaning to the individual decision maker, and which may help to reduce the decision maker's level of uncertainty'.

Information, as I use the term, aligns with Buckland's (2012:2) restriction to 'its traditional association with human knowing and learning'. In such a view, Buckland's (2012:3) discussion of information-as-process is significant for the link this category of information has, in 'the imparting of knowledge, with learning'. Buckland also recognises the role of prior knowledge, claiming that learning depends on it.

1.2 Information behaviour in schools

The information behaviour of students is embedded in the practice of schools. A sociocultural perspective to such behaviour, Francke, Sundin and Limberg (2011) contend, has implications for the analysis and study of information literacy, which, although difficult to define, is generally associated with 'locating, evaluating, synthesising and communicating information' (Ladbrook & Probert 2011:106). This echoes Breivik (1998:6): 'To be information literate, a person must be able to recognize when information is needed, and have the ability to locate, evaluate, and use effectively the located information'. Information literacy may be evident in the individual's application of skills in online reading comprehension, for example (Ladbrook & Probert 2011). Francke, Sundin and Limberg (2011) identify a set of four assumptions for studying information behaviour within the school context: the meaning of information literacy is revealed through the practices of contemporary schooling; information literacy will vary according to the social setting (an instance of which is the school setting); for an understanding of students' literacies, we must understand the classroom; and the available tools will influence students' information behaviour. The present investigation seeks, ultimately, to pay more attention to learning than to information literacy. As the task set for the student reflects the purposes of learning, information seeking must be viewed in that context, thus focusing on human-information interaction, and taking an ecological view of such behaviour. The current study is therefore a use-in-context one in which 'tasks are relatively complex, and often involve searching multiple information sources, typically over many information-seeking episodes' (Warwick, Rimmer, Blanford, Gow & Buchanan 2009:2404).

Students' assessments of relevance and reliability form part of their problem-solving heuristics; essentially, these are some of the processes by which the students move from their search question to the answer to their question, which takes the form of the product they present to the teacher for assessment. When students understand task goals, particularly when they have developed research questions that are authentic and thus open-ended, this understanding guides such information seeking behaviour as relevance and reliability assessments (Limberg 2007). In Table 1.2, four combinations of the relevance and reliability of an information source are portrayed. Ideally, a user would favour Situation 1, in which relevance and reliability of information sources are both evident. Situation 2 shows the

possibility that relevant information is used, despite its untrustworthiness; in such a situation, it may be that no other information is available. In Situations 3 and 4, it seems logically unlikely that a user would use the information source, given a lack of relevance; however, it is possible that a credible and dependable source would provide information irrelevant to the needs of the user, making Situation 3 plausible. Situation 4 is also theoretically possible and applies to a case where the information found is both irrelevant and offered by an unreliable source; in this case, a lack of relevance would presumably have led to the rejection of the source before any test of its reliability could be carried out.

Situation	***Relevance of source***	***Reliability of source***
1	+	+
2	+	-
3	-	+
4	-	-

Table 1.2: Combinations of the relevance and reliability, respectively, of sources

The learning context investigated here is the widespread one of students learning from multiple information sources (Mason, Boldrin & Ariasi 2010). The study focuses on those information processes, rather than their product, which are adopted by students to complete tasks generally referred to as research assignments or projects (or, in the United States of America, term or research papers). In higher education, such tasks may be more commonly known as literature based assessment tasks, but describe the same task, in essence: 'the written assignments (essays or reports) students complete in many subjects and faculties in Australian universities, as the major mode of assessment' (Parker 2001:online). Pirolli and Card (1999:647) refer to such tasks as knowledge-crystallization tasks, which they define as the type 'in which a person gathers information for some purpose, makes sense of it, then packages it into some form for communication or action'. The use of multiple texts, rather than a single textbook, in instruction appears to improve student learning. When Nokes, Dole and Hacker (2007) compared comprehension of historical content from multiple texts with that from a single textbook, they found that learning from multiple texts was superior, whether or not the teachers focused on content or the heuristics of sourcing, corroboration, and contextualisation in their instruction. Participants in the Nokes study were 11th grade students from a city in the western United States of America of a similar age to the students in my study. I acknowledge that 'integrating information from multiple documents is a highly

demanding task that involves more processes than those involved when just reading a single text' (Cerdán & Vidal-Abarca 2008:209). The differences between various sources 'may cause students to consider different lines of reasoning, making possible a cascade of thought processes' (Muller, Sharma & Reimann 2008:290) that lead to revisions in their schemas, that is, their 'sets of inter-related conceptual categories' (Baran and Davis 2006:291). Such thought processes form part of the phenomena investigated in the current study. Taking the student's task as the unit of analysis permits some of the learning strategies of students, that is, their processes for approaching such tasks, to be revealed. Such an investigation is aligned with the process-centred works of Kuhlthau (2004), Limberg (2007) and Parker (2006).

Students bring states and skills to information search tasks, including their motivational state; their prior knowledge (both procedural and declarative); and their cognitive skills to understand, process and apply information. Mason, Boldrin and Ariasi (2010) refer to Kuhn's distinction between cognitive meta-knowing and strategic meta-knowing, associating the former with declarative knowledge and the latter with procedural knowledge. Wolters (2003:189) writes about self-regulated learners as having 'high levels of knowledge about different cognitive learning strategies' and 'the ability to select, monitor, and regulate their use of those strategies when engaged in academic tasks'. Most information search tasks require students to exercise considerable control over their own learning processes; such tasks assume reasonably high levels of cognitive and metacognitive skills for monitoring and reflecting on learning. Judgement and monitoring are metacognitive processes (Mason, Boldrin & Ariasi 2010). Wolters (2003) finds some support in the literature for the view that regulation of motivation influences student learning and achievement. Although not focusing explicitly on motivation, the present study, is expected to reveal participants' cognitive processes underlying their decisions to use information.

The epistemological framework of the information searcher influences the criteria of relevance used by the searcher (Budd 2004). In the literature of epistemology, Mason, Boldrin and Ariasi (2010) identify two major aspects: beliefs about what knowledge is; and beliefs about the process by which we come to know. Within epistemic beliefs, they recognise the dimensions of 'source of knowledge' and 'justification for knowing'.

Of interest in my study is justification for knowing, described as 'what makes a sufficient knowledge claim, ranging from the belief in observation or authority as sources, to the belief in the use of rules of inquiry and evaluation of expertise' (Mason, Boldrin & Ariasi 2010:69). Judgements about the credibility of information are related to such factors as information seekers' views on the credentials of authors, and thus encompass an assessment of the author's expertise.

Mason, Boldrin and Ariasi (2010) outline Kitchener's (1983) cognition model with its three levels of cognition, metacognition and epistemic cognition. They include in metacognition, 'all metacognitive processes through which knowledge about cognitive tasks is activated, for example the use of a strategy, as well as monitoring its use' (Mason, Boldrin & Ariasi 2010:70). My study investigates students' learning strategies with respect to information finding and use. At the epistemic cognition level, Mason, Boldrin and Ariasi (2010:70) note the cognitive process of 'knowing about knowing, that is, an understanding and awareness of the nature of knowledge and justification criteria for the knowing process'. Hofer's (2004:44) view of epistemological thinking encompasses 'how individuals evaluate ideas, coordinate theory and evidence, and justify their knowledge assumptions'. The connection with the current study is in the justifications given by students for their judgements of the relevance and reliability of information; that is, research questions are designed to shed light on how students decide on the relevance of a piece of information, or know that information is relevant; and how they decide that information is trustworthy, or come to know that a selected piece of information can be relied upon. Epistemological beliefs form part of beliefs brought to the task of evaluating information; as claimed by Whitmire (2004:98), 'Everyone has epistemological beliefs about the nature of knowledge and when they encounter information in digital environments they make judgments about the information based upon these epistemological beliefs'.

Misailidi (2010:279) relates initiatives to unite the research traditions of metacognition and theory of mind, indicating that researchers in each field are interested in, respectively, 'children's developing capacity for thinking about – that is, monitoring (or controlling) their own thoughts', and 'the ability to think about or make inferences about the thoughts and feelings of another person'. In her definition of metacognition, the author distinguishes

metacognitive knowledge from metacognitive processes, describing the former as ‘a person’s awareness and deeper understanding of cognitive processes and products’ and the latter as ‘an individual’s ability to monitor and/or self-regulate her/his cognitive activities during problem solving’ (Misailidi 2010:280).

The distinction between metacognitive knowledge and skills is also noted by Veenman, Van Hout-Wolters and Afflerbach (2006:4), who define the former as ‘a person’s declarative knowledge about the interactions between person, task, and strategy characteristics’ and the latter as ‘a person’s procedural knowledge for regulating one’s problem-solving and learning activities’. My study assumes that students are sufficiently aware of their metacognitive processes to articulate factors used to determine the relevance and reliability of information. Metacognition is not always explicit when the researcher observes a task being performed but can be inferred from the cognitive activities of participants (Veenman, Van Hout-Wolters & Afflerbach 2006), as revealed in think-aloud reports made while engaged in a task, and in interviews in which students are asked to articulate the thinking underlying their decisions in a learning situation.

1.3 Context as an influence on information behaviour

The research context of the present study encompasses 'those factors that fall outside the realm of the fundamentally cognitive or psychological' (Courtright 2007:275), considering these phenomena of interest, and viewing context as those factors that frame the processes that impinge on a student's relevance and reliability judgements. I use 'context' in the sense that Tanni and Sormunen (2008:896) use 'environment': 'The environment comprises social norms and values, purposes and goals, routines, constraints, and available information and personnel resources'. Kelly (2006) underlines the difficulties faced when attempting to define context; its measurement is similarly challenging, she continues, because of its invisibility and ubiquity. Kari and Savolainen (2007:1) define context as 'all those things which are not an inherent part of information phenomena, but which nevertheless bear some relation to these'. Thus, the context includes factors that are beyond the individual student's unique cognitive and psychological processes, which are demonstrated while he or she is engaged in information seeking behaviour, but which have some influence on that behaviour. This broadly defines context as anything within information seeking behaviour that does not constitute a phenomenon of interest but appears to influence a phenomenon of interest.

Courtright (2007) identifies several synonyms for 'context': setting, environment, information world, life-world, and information ground. Shenton and Dixon (2003b:8) prefer the less common 'information universe', defined as 'the circumstances within which an individual requires and pursues information' (2003a:1032) and which they align with the following: information world, information environment, and the user's life world. In the light of Fallis's (2006:477) definition of social epistemology, 'the branch of epistemology that focuses on the role that social factors and social institutions play in knowledge acquisition', social epistemological factors also form part of the context in which students undertake information search tasks, with the school playing a prime role in students' acquisition of knowledge. Thus, the role of other people, not simply individual student participants, must also be considered. Consequently, Fallis (2006) contends, schools and libraries should be mindful of the effect of their social and cultural contexts on the knowledge acquisition of those with whom they interact; such institutions should be aware of their role in the socially constructed nature of knowledge. For example, Oliver and Oliver (1997) find that the context and purpose of the information seeking task, when obvious to students, influenced students' level of cognitive processing and therefore they retained and remembered more information.

Factors related to the school context, such as teachers' expectations and students' conceptions about what teachers expect (including what type of learning students are expected to demonstrate by completing the set information search task), feature in the present study.

A learner's conceptions of information seeking and use influence learning outcomes (Tanni & Sormunen 2008). The tasks set by teachers for students to complete may be categorised as information problem solving tasks. In such a view, the goal of information seeking is the resolution of an information problem. The study of goal-driven behaviour of this nature is common in contemporary information seeking research and uses 'a problem solving framework borrowed from the cognitive science approach to models of general problem solving' (Spink & Cole 2006:26). Once an individual's problem situation is considered, information is used in the subjective construction of knowledge by the individual; such a consideration also recognises the mediating influence of 'social and cultural meanings and values' (Spink & Cole 2006:30).

Ford's (2004) examination of study approaches, which are broader than learning styles, is related to resource management and effort control. A deep approach seems more likely to lead to successful outcomes in information tasks. Apparently, educators assume that a deep approach will be taken by students, thereby engaging effectively with information and learning from it. Teacher-set tasks assume that students are capable of reflexive information-literate behaviour, such as defining information needs, locating information sources, extracting and organising information relevant to information needs, and synthesising information from a variety of sources (Brand-Gruwel & Gerjets 2008). Cader, Campbell and Watson (2009:1917) point out the challenge of evaluating Web information and indicate that the associated 'complexity of judgement and decision making is related to the level of risk taking involved, which in turn can give rise to uncertainty'. Their study considered nurses' evaluation of information, in which the use of incorrect information may have extremely serious consequences for patient health. For students, generally, there are risks that the use of untrustworthy information will have an adverse effect on grade levels and therefore their academic futures. Fitzgerald (2005) considers education about the risks of misinformation to students in the twenty-first century a priority. Flanagin and Metzger (2007) contend that credibility assessments are complex, and entail assessments of author, message, sponsor

and medium; they explain scholarly interest in the topic as being based on the increased burden on the information consumer to make credibility assessments in the Web environment, as compared to similar judgements of traditional sources.

Case's (2006) literature review notes that a consideration of the context of information behaviour had become a trend; this tendency is still evident. Rieh and Danielson (2007:348), writing of the role of situational factors, assert that 'information is evaluated against a background of social and organizational norms regarding, for example, the types of facts, reasoning, and argumentation that are considered acceptable within a domain'. Fisher and Julien (2009:1) refer to the multiplicity of roles played in various contexts: 'Information behavior focuses on people's information needs; on how they seek, manage, give, and use information, both purposefully and passively, in the varied roles that comprise their everyday lives'. Cole (2011), contrasting information needs with primary needs, such as those for food, water and shelter, also argues for the importance of the context in which information needs occur. Cole's argument is based on the paradoxical nature of an information need: 'what is required to satisfy an information need is often not known to the individual concerned' (2011:1216). Directing our attention to the challenges of such tasks for school students, Shenton (2007:3) includes the paradox that 'In order to access information in a source, the user must often apply knowledge that he or she does not yet possess'.

In the school context, students are engaged in a question-type of information search in which an information system is searched for an unknown item or unknown answer; such a search has also been referred to as a subject search, a topic search, an exploratory search, and an ill-structured problem (Cole 2011). A question-type of information search poses a challenge to the individual with limited domain knowledge, giving rise to difficulty identifying what the individual does not know, and therefore needs to find out. Most students, however, successfully use their limited prior knowledge to construct a search string to use in an information system. Using Taylor's model of information need, Cole (2011:1219) proposes that such an information need as displayed by a student has a question intention, 'to explore a topic area when the item or the form of the answer is unknown to the user'. The context of such information seeking behaviour establishes the purpose, and therefore the motivation, of the behaviour. The context prompts the individual to think evaluatively. Fitzgerald (2005) suggests that goals, prior knowledge, recalling past experiences, topic knowledge and epistemological orientation influence an individual's approach to evaluation. Similarly, Rieh

and Danielson (2007:348) note that an interest in the background of the person evaluating the information, including 'existing knowledge and beliefs', is evident in all credibility assessment research.

The context of the present investigation includes the participants' conceptions of the pedagogical intentions underlying the design of the information search task; participants' prior knowledge of both content and procedures for completing the task; and their motivation for choosing topics, where choices are offered. As task designers, teachers become indirect participants in the study. Students have formed views of which information practices have been rewarded by teachers in the past; for example, they have hypotheses about which practices are most likely to lead to higher grades; the importance teachers attach to the use of reliable information; the level of original thought that is expected, as opposed to a synthesis of others' views; and the depth of topic treatment that they should demonstrate.

1.3.1 Context, learning, and learning task

Given the central role of information in learning, inevitably any study of information behaviour, particularly in a school environment, will reveal aspects of learning. Ford's (2004:204) definition of learning, the 'modification of an individual's mental structure resulting from the processing of information', makes explicit the link between learning and information. I have adopted Ford's (*ibid.*) definition of information, noting that it applies in the context of information behaviour that is related to learning: 'recorded knowledge retrievable from collections of multiple independent information sources'. Further linking learning and information, Ford (2004:184) defines learning-related information behaviour:

> Those activities a person may engage in when, for the purposes of learning, identifying his or her own needs for information, searching for and selecting such information from multiple independent information sources, and using or transferring that information.

Ford's definition should be considered alongside Limberg's (2007) discussion of the nature of an information search task in the context of the school, which considers the theoretical and empirical implications of task as a concept. Tanni and Sormunen (2008:896) define a

task as ‘a description of a goal, a purpose, implementation methods, requirements and a meaningful outcome’ and note that information seeking and searching subtasks are common within a broader task that requires an individual to interact with and process information to complete that broader task. A move towards considering the tasks set by educators as a special case of information seeking is apparent. Rieger (2009), for example, considers that search engine use is embedded in the task of teaching, learning and research of the university students and faculty participating in her study and must be examined in that context. Her theoretical framework, thus, conceives information searching ‘not as a discrete activity but as an effort that is integrated into a full academic workflow of thinking, conceptualizing, writing, reading, reviewing, and reflecting’ (Rieger 2009:online). The goal of information seeking is to apply found information to the academic task set by the educator. The learning experience, if viewed as ‘the moment when we actively acquire the knowledge that is missing in order for us to complete the needed tasks or solve a problem’, is preceded by ‘exploration, inquiry, decision making, selecting, and deselecting’ (Siemens 2006:25). Commentators such as Savolainen and Kari (2006) assume an underlying task to motivate a Web search process, with the searcher judging the extent to which the found information is relevant to that search task. The present study focuses particularly on the decision making aspects of learning; the processing of information interacts with the structure of the task environment and influences decision behaviour, particularly the strategies selected for goal achievement and the related trade-offs between accuracy and effort (Tang 2009). School-based tasks described here match Moos and Azevedo’s (2008:272) description of self-regulated learning (SRL) as ‘actively constructing an understanding of a topic/domain by using strategies and goals, regulating and monitoring certain aspects of cognition, behavior, and motivation, and modifying behavior to achieve a desired goal’.

Savolainen (2009:online) describes information use as ‘a catch-all phrase that generally refers to how people access information sources and absorb the information available in them’, through both physical and mental activity. Information use behaviour entails an individual integrating information into a knowledge base (Spink & Cole 2006). Like Ford (2004), I view learning as occurring when new information is integrated with existing knowledge, which reveals a constructivist interpretation of learning; the learning of new information is accomplished in a process of accommodation familiar to students of Piaget (see, for example, Boyle 1969), in which information that can be fitted into an existing cognitive framework is assimilated. Similarly, Hofer (2004) writes of a knowledge acquisition and construction

process, with which she associates the activation of epistemic monitoring and evaluation. Simons (1993) characterises constructive learning as an active, constructive, cumulative and goal-directed process: the student is actively involved in processing incoming information to make meaning of it, relating it to other information, using his or her prior knowledge (see also Savolainen & Kari 2006), and monitoring progress towards a goal. Simons's (1993) references to diagnosis, reflection, and awareness of learning style as components of constructive learning associate it with elements of metacognition. This is consistent with Veenman, Van Hout-Wolters and Afflerbach (2006:4), who associate the following terms with metacognition:

> Metacognitive beliefs, metacognitive awareness, metacognitive experiences, metacognitive knowledge, feeling of knowing, judgment of learning, theory of mind, metamemory, metacognitive skills, executive skills, higher-order skills, metacomponents, comprehension monitoring, learning strategies, heuristic strategies, and self-regulation.

Ford's (2008:498) definition of educational informatics, 'the development and application of digital technologies and techniques that use pedagogical knowledge representations in order to facilitate or engage in educational resource discovery for learning', puts my study outside his conceptual framework. Students were discovering resources by means of knowledge representations not designed specifically for learning purposes within an educational institution. Ford distinguishes between educational informatics systems and 'say, the use of an information retrieval system such as a Web search engine to locate educational materials' (2008:498-499).

Learning and information are intertwined. We use information to build on our prior knowledge, thereby creating new knowledge. If we evaluate the information that we use in the process of constructing new knowledge, then we are exercising discrimination, sorting relevant from irrelevant information, and separating unreliable from reliable information. During that discrimination, we employ critical thinking and use criteria that we have developed in our past interactions with information; we draw on our mental models of what constitutes relevant and reliable information.

1.4 Evaluation of information

Fitzgerald and Galloway's (2001) examination of the literatures of metacognition, critical thinking, and cognitive psychology draws together aspects of the individual and the situation in which an evaluation of information is made. They note the influence of 'the individual's disposition toward critical thought and the purpose for using the information' (2001:991) when an individual evaluated information, and draw attention to a metacognitive message, or signal, that triggers the process of evaluation. Fitzgerald (2005) raises the likelihood that the individual's disposition varies from situation to situation. The outcome of the evaluation process is a decision, and the thinking that occurs while making such a decision may be affected by factors such as the individual's 'development, epistemology, affect, beliefs, and prior knowledge within the problem domain' (Fitzgerald & Galloway 2001:992).

Relevance and reliability of information are aspects of information quality, and thus are associated with information evaluation. Hilligoss and Rieh (2008:1469) use 'information quality' to refer to 'people's subjective judgment of goodness and usefulness of information in certain information use settings with respect to their own expectations of information or in regard to other information available'. Some researchers consider credibility part of the broader concept of quality (Rieh & Danielson 2007). Criteria for judging quality in the print environment are not readily applicable in the online environment (Candy 2004); for example, if no author details are immediately apparent, a laborious process of tracing such details may be needed. Studies by Metzger and Flanagin reported in Metzger (2007) indicate that actions to verify information quality are unlikely when they entail time and effort; verification using an opinion about whether Internet information was current or complete, for example, was more commonly used to check quality than more effortful verification, such as verifying authors' credentials. Implicit in information foraging theory is that people will pay most attention to information that they think will be useful to them, thereby making allocation of attention a central concern (Pirolli & Card 1999). Lim (2009:2192) defines information quality as 'one's evaluative judgment of the goodness of information' and measured respondents' judgements of it, using accuracy, verifiability, reliability, comprehensiveness, fairness, and overall writing quality. Reliability as a characteristic of information quality, from Lim's perspective, is aligned with my conceptual framework. Fitzgerald and Galloway (2001) observe that information science literature generally treats evaluation and relevance

judgements as components of each other (here, they do not view relevance judgements as evaluations, using evaluations to mean, essentially, reliability judgements). Their research suggests separate mental processes, even though they were not always able to be categorical about which data segments in their study fell exclusively into one or the other of the two processes. For educational reasons, the constructs of relevance and reliability should be disentangled, even though judgements of these two characteristics occur very close to each other.

Wathen and Burkell (2002) maintain that we filter out most of the information that we encounter and that we apply the criterion of credibility, or believability, to assess information. Baran and Davis (2006), similarly, believe that we pay attention to only a small amount of the information to which we are exposed. Miller (2010) notes the irrelevance and misleading nature of some information, suggesting that continuing to search for information is sometimes counterproductive and a hindrance to decision making. Our attention is attracted by the relevance and reliability of information. In this report, I use 'reliability' as a synonym for credibility, believability, and trustworthiness. In the following sections, I consider the constructs of relevance and reliability, respectively.

1.4.1 Construct of 'relevance'

Since the 1960s, researchers have attempted to isolate the criteria used in relevance judgments (Xu & Chen 2006). Chu (2011) explicates the centrality of relevance to the field of information retrieval (IR), indicating that results retrieved by a search are judged for their relevance. Similarly, Tombros, Ruthven and Jose (2005) contend that relevance is a fundamental concept in IR. On the other hand, Hjørland (2000b) and Fallis (2006) argue that epistemology is the central philosophical concept in information science. Hjørland's position is based on the cognitive view that whenever information is processed, it is mediated by the individual's model of the world. In this view, the individual's epistemological framework is broader than any relevance judgements made within it. A perspective maintaining the centrality of relevance is not antithetical to the view that epistemology is fundamental; rather, considering that an individual's epistemological framework mediates his or her relevance judgements, they are complementary.

Information science research is generally characterised as bifurcated in relation to relevance research, with one group working on relevance that is based on the information system and another working on relevance as perceived by the user, although the boundaries are sometimes less strongly drawn than they once were. The focus of the former group is on information retrieval algorithms, the effect of which is to treat relevance as an objective measurement of topicality; the focus of the latter group is on user behaviour, resulting in a view of relevance as subjective, dynamic and encompassing more than topicality (Xu & Yin 2008). A focus on the information system indicates that relevance has been theorised as a property of information, while a focus on the user indicates its conceptualisation as a judgement about information (Bade 2007). Equally, the former focus reveals a human-computer interaction, while the latter shows a human-information interaction (Rieger 2009). In his conceptual paper, Bade (2007) suggests that information system-focused relevance represents a reification of relevance and is seen in a 'match' between search terms and what is retrieved by the system; in user-focused relevance, retrieved results may said to 'satisfy' the user because of the relevance perceived by the user in those results. To avoid confusion of the two types of relevance, Bade (2007:841) advocates that 'relevance' be restricted to user judgements and that another word be found for 'programmers' context-free estimates based on surrogates and expressed in algorithms'. Nov and Ye (2008:848) attempt to integrate the two types of relevance in their definition: 'Relevance refers to how well a computer system matches the tasks users need to carry out with it'. Their definition is closely aligned to Vakkari and Hakala's (2000:541): 'the relation between the actor's information need and the information in the documents that contribute[s] to the solution of his or her information problem'. Because the information need is inextricably blended with the task, and relevance judgements are based on the extent to which information sources meet that need, such a view of relevance is referred to as situational or task-embedded (Vakkari & Hakala 2000).

Relevance goes beyond topic-appropriateness (Tombros, Ruthven & Jose 2005) or topicality (Coppola, Della Mea, Di Gaspero & Mizzaro 2004; Heinström 2002; Schamber, Eisenberg & Nilan 1990; Tang & Solomon 2001; Taylor, Zhang & Amadio 2009; Twait 2005; Xu & Yin 2008); and it is not dichotomous (Desai & Spink 2005; Taylor, Zhang & Amadio 2009; Vakkari & Sormunen 2004). Consensus about users' relevance criteria began to emerge around a decade ago (Maglaughlin & Sonnenwald 2002); however, Tang and Solomon (2001:678) assert that 'there is still no consensus on the categorization and labeling of the classes of criteria'. Apparently, the potential of information retrieved by a system to solve a

problem is of greater interest to a searcher than finding a very strong correspondence between search results and query (Heinström 2002). In the current study, the relevance focused upon is the usefulness to the student of the information retrieved; following Tombros *et al.* (2005), this may be called a user-utility view of relevance.

Barry and Schamber (1998) note a shift from a focus on relevance determined by information systems to a focus on the user's experience of a cognitive, dynamic process of determining relevance. Wang and Soergel (1998) also comment on the shift to user-centred studies; more recently, Twait (2005) confirms the trend that emphasises relevance judgements from a cognitive perspective. Models are of relevance assessments 'insofar as information seekers must make judgements in order to predict or determine whether information at hand will help resolve their information problems' (Barry & Schamber 1998:221). Barry and Schamber (*ibid.*) define relevance broadly to encompass 'any or all individual perceptions of internal and external reality related to the information problem situation'. Their definition assumes that the concept is subjective, situational, multidimensional, and, despite its dynamism, 'systematic, observable and measurable at a single point in time' (*ibid.*). Chu (2011:267) repeats the widely accepted view, established by a literature review covering the previous thirty years, undertaken by Schamber, Eisenberg and Nilan (1990): 'relevance is dynamic, multidimensional and contextual'. Researchers such as Taylor, Zhang and Amadio (2009) and Savolainen and Kari (2006) echo these properties, with the latter adding that relevance is influenced by cognitive, affective and sociocultural factors. Taylor, Zhang and Amadio (2009:720), however, articulate elegantly the lack of consensus about a definition of relevance:

> The indistinct philosophical foundations of the concept of relevance coupled with the difficulty of measuring the cognitive and situational aspects of it have led to a number of definitions of the term in information science with no single, canonical interpretation of the concept.

Buckland (2012:4) claims that 'there is no such thing as relevance, at least nothing tangible', asserting that a substitution of 'suitable' for 'relevant' does not affect its meaning. He implies that relevance has acquired a pseudo-scientific standing for two reasons: 'it has a formal meaning of entailment in logic and because of 50 years of relevance measures in information

retrieval evaluation' (Buckland 2012:5). The author argues, furthermore, that neither a 'measurable physical property' nor 'a clear and rigorous definition … is available and one must do the best one can with the least unsatisfactory surrogates' (*ibid.*).

Anderson's (2006:7) study 'sought to explore relevance assessments as part of the decision-making processes of individuals doing research', defining relevance as 'the process by which encounters with new information are related to what is already familiar'. Relevance begets relevance; relevance perceived in one information source, or in one part of a source, influences what will be perceived as relevant in the next source, or part of that next source. Time, and its concomitant development of knowledge, may thus be considered an influence on relevance judgements (Taylor, Zhang & Amadio 2009).

An individual will find that parts of an information source may be relevant while others are not, and will seldom find that the entire source is relevant to his or her needs. Furthermore, he or she will often find that no single document is as complete a treatment of the topic under investigation as desired (Ruthven 2005). An information searcher, if aware of his or her information need, has an emerging set of relevance criteria based on that need and thus 'The development of the information need is to some extent the development of relevance criteria' (Hjørland 2000a:210). The development of a taxonomy of relevance criteria applicable in multiple contexts, however, 'turns out to be a rather unrewarding process because of the differences in the definitions and categorizations of the criteria' (Tang & Solomon 2001:676).

Ruthven (2005) maintains that one of the main topics for information seeking research has been a study of relevance criteria to shed light on the decision making process of people. I have used Schamber and Bateman's (1996:online) definitions, respectively, of *relevance judgements*, as 'users' decisions to accept or reject specific information items at a certain time'; and *relevance criteria*, as 'the factors or reasons that contribute to users' relevance judgments'. By extension, *reliability judgements* are users' decisions to accept or reject specific information items, usually once they have been judged relevant; and *reliability criteria* are those factors or reasons that contribute to users' reliability judgements. An exposition of the construct of reliability appears in the section following.

1.4.2 Construct of 'reliability'

Rieh and Danielson (2007) notes that several researchers operationalise credibility in terms of reliability and accuracy, and that credibility judgements are generally viewed as a subset of relevance judgements. Hilligoss and Rieh (2008) indicate that credibility, believability, trust, reliability, accuracy, fairness, and objectivity have been used synonymously in the literature. They note a lack of clarity in definitions of credibility. The authors, therefore, discuss trustworthiness and expertise as two key dimensions of credibility on which researchers agree. Trustworthiness, they write, is attached to information 'when it appears to be reliable, unbiased and fair' Hilligoss and Rieh (2008:1469). Hilligoss and Rieh (*ibid.*) assert that expertise is 'closely related to user perceptions of the ability of a source to provide information both accurate and valid'. Xu and Yin (2008) adopt a similar position, considering judgements of reliability to form part of relevance judgements. Such judgements form part of the critical discrimination of an information-literate person interacting with information; information literacy extends beyond literacy in information and communication technologies (ICT), as suggested by Candy (2004), who writes of information literacy as a 'set of attributes that pertain to the ability to solve information and learning problems, more or less independent of the form in which that information is provided' (2004:85). Buckland (2012) articulates the reason for trust judgements: we depend, largely, on the knowledge of others, that is, we rely on second-hand knowledge; this situation arises because we are, for the most part, not able to develop knowledge about all we need to know on the basis of first-hand knowledge established through direct experience. In Buckland's (2012:3) view, 'In real life, we have imperfect *knowing about* and we have to rely more on trust than on truth'.

Gil and Artz (2006:568) distinguish between reliability and credibility on the basis that 'Reliability is typically based on credentials and past performance of the source. Credibility specifies the user's view of probable truth of a statement, given all the other information available'. They cite a situation in which 'a completely reliable source may provide some information that may be judged not credible given other known information' (*ibid.*). While they are attempting to differentiate between entity trust (source credibility?) and content trust (reliability of specific pieces of information?), in the longer term, regular judgements of reliability of related sources are likely to lead to the conclusion that sources are credible. The present investigation does not distinguish between reliability and credibility. Even though it does not consider reliability to be a subset of relevance (for the sake of conceptual clarity), the

study treats reliability broadly, thus encompassing trust, credibility and accuracy, and treating these terms synonymously.

Gil and Artz's (2006) work is particularly interesting for attempting to develop system-provided features to assist the user to find reliable information, a service that simulates the cognitive analysis of the user, although it fosters dependence on the information system's algorithms and thus risks the deskilling of the user. Some information systems would probably develop a reputation for being trustworthy providers of reliable information, thus shifting trust from the level of the individual resource and the provider of that resource (an individual or organisation) to the information system provider. Gil and Artz (2006:574) call for semantic representations of Web content that will 'enable the detection of related statements and whether they are contradictory'. This hints at what may be available in the future: a feature provided by an information system that does some of the 'heavy lifting' of intellectual activity for the user, but that uses our inclination to seek corroboration in order to establish trust in a piece of information.

1.5 Decision making

A decision is typically defined in classical decision theory as 'a choice among alternatives that will yield uncertain futures, for which we have preferences' (Howard 2007:40). In simple terms, decision making is the choosing of a course of action from a set of options (Agosto 2002). Berryman (2008a:197) defines a decision as 'that point at which an individual commits to action, a commitment which comes after an assessment of the options or choices available'. This echoes Newell, Lagnado and Shanks's (2007:19) definition of a decision as 'a commitment to a course of action', which the authors distinguish from a judgement, defining that as 'an assessment or belief about a given situation based on the available information'.

Modern views of decisions take into account past experiences of the decision maker and acknowledge the influence of outcomes of decisions on future decisions. Betsch and Haberstroh (2005:361) conclude that 'decisions are no longer viewed as singular or isolated events in time, but as being embedded into the stream of the individual's experience'. While much research focuses on a particular point when a decision is made, Berryman (2008a, 2008b) agrees that the decision making process is broader, with judgements preceding the point of decision able to explain the decision. Formerly, classic decision theory had focused on the point of selection, without taking into account the respective stages before and after selection.

Carruthers (2009:133) distinguishes between a decision and a judgement, but a strong distinction between the two will not be drawn in this study. Newell *et al*. (2007:25) provide four key processes in the making of judgements: discovering information; acquiring and searching through information; combining information; and feedback. Savolainen and Kari (2006) conceptualise relevance judgements as preceding decision tasks, explaining that relevance judgements are based on the needs of the information searcher, while decision making results in acceptance or rejection of sources judged to be relevant. They acknowledge that although 'these processes intertwine, they are not identical in that relevant documents would be always accepted and non-relevant ones rejected' (Savolainen & Kari 2006:705). Fitzgerald and Galloway (2001:992) describe a judgement as a qualitative assessment, differentiating it from a decision, which 'ends in an action after taking possibly conflicting judgments into account'. They draw attention to the view of advocates of information literacy

and critical thinking theorists that critical thinking is important in the decision making process for its effect on the action that ensues. The judgement of the individual is seen in the decision to use, or not use, the information source under consideration (Fitzgerald & Galloway 2001). For Lynch (2006), critical thinking is evidenced in the application of the individual's prior knowledge to the solving of problems (see also Savolainen & Kari 2006), the making of decisions, or critically evaluating an object of interest in relation to a set of standards. When my study participants decided which information to use, and evaluated information against their standards for relevance and reliability, I considered them to be thinking critically.

Decision making theory appears to live with a tension between normative decision making theory, which offers a prescription for how people *should* make decisions, and naturalistic decision making theory, which offers a description of how people *do* make decisions. The current study leans explicitly towards the latter position, in which naturalistic decision making (NDM) is defined as 'the way people use their experience to make decisions in field settings' (Zsambok 2005:4). The NDM field is associated with the study of how experts behave in circumstances that require them to make decisions and its focus is on how they bring their experience to bear on a situation. Their reactions in such situations can be used in training novices, who learn and apply the strategies of experts. A key element in NDM is the mental simulation of an intended course of action after the individual has sized up a situation and considered what action is needed. The individual imagines the application of the action and considers what adjustments need to be made before pursuing that action. Without mental simulation, this aspect of NDM would not be distinct from pattern-matching in which the individual assesses the extent to which the new situation matches the mental model of a pattern, developed as a result of past experience (Pliske & Klein 2003). The emergence of NDM was, in part, a reaction to laboratory-based investigations, which were considered unable to take into account the rich, dynamic nature of real-life decision making (Doherty 2003:646). Investigators interested in a different approach wanted to examine how decisions were made 'in field settings characterized by stress, time pressure, and uncertainty' (Pliske & Klein 2003:562). The NDM field emerged from a desire to depart from normative models of decision making, which NDM researchers perceived as inadequate to describe and explain how people make decisions in complex, natural settings. Their interest has therefore been in 'strategies people use rather than detecting deviations from a normative standard of performance' (Pliske & Klein 2003:561).

Klein and colleagues have proposed a model situated within the field of NDM, namely recognition-primed decision making (RPD) (Newell *et al*. 2007; Pliske & Klein 2003). While NDM is characterised by a process of matching a pattern in a novel situation to patterns encountered in the prior experiences of an individual, which is then followed by mental simulation (a rehearsal in the mind of how the proposed decision will play out when applied in real life), RPD relies on the recognition of a cue or cues that represent a pattern (Ross, Lussier & Klein 2005). RPD, as a model of tacit decision making, is distinct from classic decision making models, 'which postulate that decision making requires deliberate analysis and comparison of a number of alternative courses of action prior to a decision being made' (Ross, Lussier & Klein 2005:328). Like its parent, NDM, RPD depends on the recognition of a pattern derived from past experiences; unlike its parent, RPD is stimulated without full recognition of the pattern, but after the recognition of salient cues in the decision making environment that evoke that pattern. These cues, in a process of which the decision maker is largely unaware, activate a set of associations of expectancies, goals and actions that are used as the basis of a decision.

The current study defines decision making as the making of a choice from a set of options, and considers decision making to culminate in a judgement that is based on criteria applied by the decision maker.

1.5.1 Heuristics

Simon (1990:11) points out that heuristics are 'not optimizing techniques', but are instead 'methods for arriving at satisfactory solutions with modest amounts of computation'. Heuristics are pattern-based rules that individuals use to reduce the complexity of decision making and are employed in response to the natural limitations of our mental resources (Berryman 2008a, 2008b). Keller, Cokely, Katsikopoulos, and Wegwarth (2010:257) define a heuristic as 'a computational algorithm that can be implemented in an information-processing system (human, animal, or machine)'. Miller (2010), writing in the field of economics, notes that the use of such mental shortcuts to make decisions reduces cognitive costs, while risking the occasional failing of the heuristics.

Savolainen and Kari (2006:686) suggest that Web searching is reliant on heuristic strategies in which browsing 'draws on the recognition of useful links and pages'. They refer to the

complexity of selecting websites, referring to the judgements and decision making involved in the process. The application of heuristics simplifies that process, thus circumventing the weighting and integration of multiple cues to make decisions.

Heuristics are associated with non-compensatory strategies of decision making, as opposed to rational choice theories of decision making, which are compensatory, considering that they assume that multiple cues are weighted and integrated in the decision making process. Gigerenzer and Brighton (2009:109) argue that the use of heuristics may result in more accuracy than has often been associated with the employment of more complex procedures: 'less information and computation can actually lead to higher accuracy'.

1.6 Aims

This study examined the relevance and reliability criteria applied to information by a group of students in Years 9 to 11 in an independent school in south-eastern Australia as they undertook information search tasks. Whether students used digital or printed forms of information was essentially irrelevant; however, students demonstrated a distinct preference for the former type. The aims of the study were:

- to examine and interpret judgements about the relevance of information made by the participating students;
- to examine and interpret judgements about the reliability of information made by the participating students;
- to identify the processual context in which both relevance and reliability judgements were made;
- to develop a grounded theory in relation to the above.

1.7 Conclusion

The conceptual framework of my study is primarily that of information behaviour motivated by an information need. Such behaviour entails information seeking and searching with the intention of discovering information that is relevant and reliable. Furthermore, such behaviour is embedded in the tasks set by teachers with the purpose of having students find, and make sense of, information in a relatively independent manner.

Research interest has focused on relevance, with interest in reliability (commonly, 'credibility') becoming evident only in the 1990s. The advent of the Internet may have sparked such interest; certainly, Internet sources are now widely used by students to complete information search tasks. The effect of the Internet on learning is of interest to educators as well as parents, with concerns about the credibility of Web-based information regularly voiced. Conclusions about reliability of Web sources sometimes cannot be easily drawn; for example, empirical and anecdotal evidence about *Wikipedia* appear to contradict each other.

While distinguishing between information seeking and information searching, with the former term considered the broader, my particular focus is on how students process found information, that is, how they make sense of it as they interact with it in the process of completing information search tasks set by teachers. The specific aspects of students' information processing singled out for attention are their judgements with respect to the relevance and reliability of information, with judgements of this nature assumed to flow from sets of criteria for making them. Such an approach is anticipated to illuminate some of the processes by which students evaluate information, thus also illuminating their metacognitive strategies. Judgements of credibility, particularly, are likely to reveal students' epistemological beliefs also.

Information plays a key role in learning, and information search tasks undertaken by students typically entail the use of multiple information sources. The curriculum-based task is emerging as a specific case of information seeking; the school context brings with it a particular set of situational factors, such as students' perceptions of the task and the expectations of teachers, which influence relevance and reliability judgements.

Relevance, as judged by the user, extends beyond mere topicality, and is the quality of the information used by the seeker to determine if it meets, or does not meet, an information need. Such user-based relevance is distinguished from relevance determined by an information system, such as a search engine or database that matches search terms to terms in information sources. The reliability of information is the extent to which the user considers it accurate, credible, dependable or trustworthy.

Individuals make decisions about the relevance and reliability of information and thus results will be discussed from a decision-analytic perspective. The use of think-aloud protocols, and the ensuing spontaneity in the application of heuristics without specific instructions to participants to focus on relevance and reliability criteria, suggests a discussion of results from the perspective of naturalistic decision making.

1.8 Structure of thesis

In the next chapter, I review studies concerned with the investigation of one, or both, of the following: relevance criteria and judgements; and reliability (or credibility) criteria and judgements. This review reveals that most studies are of university-level students and faculty, and some are of the broader population, but few are of school students. I raise three research questions at the end of that chapter relating to secondary school students' relevance criteria, their reliability criteria, and the context in which these two sets of criteria are applied in the decisions that students in the investigation made when using information to complete tasks assigned to them by their teachers. These tasks were in a range of school subject areas.

Following the literature review of relevance and reliability studies, respectively, I turn to the methodology employed in the current study. Chapter 3, on the study's methodology, outlines its research design, the reflexivity of the researcher, methods of data collection and analysis, and various issues surrounding data collection. Chapter 3 details three small-scale studies, noting each study's participants, and methods of data collection and analysis.

Chapter 4 reports the findings of the investigation, noting the criteria used by middle and upper secondary students in an Australian school (aged 14 to17) to decide, respectively, on the relevance and reliability of information that they had retrieved independently for the purposes of completing assigned tasks. The chapter also details the processual context in which those relevance and reliability criteria are applied, that is, the context of processes of making relevance and reliability judgements. Several tables in the appendices support the findings. These framework matrices, although introduced in Chapter 4, are more specifically and extensively referenced in Chapter 5, in which the investigation's findings are discussed.

Chapter 5, in its discussion of the study's findings, uses the five themes that relate to the context in which participants made decisions about the relevance and reliability of information. This chapter also canvasses selected implications for teaching and learning raised by the study's findings.

The final chapter concludes the thesis by considering the significance of the investigation's findings, limitations of the current study, and future research work.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The literature surveyed here encompasses studies of the relevance and reliability of information, respectively. It notes that most studies of participants' perceptions of relevance have investigated university students and faculty, and that few studies have been made of school students' relevance criteria and judgements. With respect to studies of reliability, a notion that in this thesis I have treated as synonymous with credibility, a similar situation exists; however, the proportion of reliability studies of school students to those of university students and faculty is greater than the proportion of relevance studies of school students to those of individuals at universities. My reading suggests the number of studies in each area, relevance and reliability, in which researchers have related their work to decision making, is quite low. A study of school students' relevance and reliability criteria, viewed through the lens of decision making theory, thus addresses a gap in the literature.

2.2 Studies of relevance

A two-article review by Saracevic (2007a; 2007b) of the relevance literature that had been published in the preceding thirty years is a key recent work. In his review, Saracevic (2007a) focuses on relevance from the point of view of the information user, rather than the perspective of the information system. This distinction is one between user relevance and systems relevance; Saracevic deliberately focuses on the former in his review of relevance as a 'human condition' but acknowledges its intersection with the latter type. He also focuses on studies where relevance has been explicitly stated in a research question, rather than including those where the phenomenon of relevance has been implied as part of the broader experience of users seeking information (Saracevic 2007b). In doing that, he acknowledges that several information seeking studies address relevance, noting that whenever decisions are made to use information, relevance is implicit in the decision making process (2007b). Saracevic's work is an important introduction to any consideration of relevance and very helpful to gain a macrocosmic view of relevance as experienced by users.

Emphasis in this section falls on user relevance; the focus is thus on studies of assessments of relevance by users. In a view that accords with Saracevic's outlined above, Kelly (2005:169) contends that 'The concept of relevance … is necessarily a part of any theory of information-seeking and retrieval'. A common thread in the literature, however, is that there is no agreement about what relevance is (Cosijn & Ingwersen 2000; Jacsó 2006; Otterbacher & Radev 2008; Saracevic 2007a; Spink, Greisdorf & Bateman 1998). Despite this, the phenomenon is intuitively understood; its nature, and its various manifestations, can be defined and investigated. Borlund (2003:913-914) asserts that recent renewed interest has resulted in a 'consistent and compatible understanding' of the concept of relevance, resulting in a phenomenon that can be 'approached conceptually and operationally from the user's perspective'.

Kelton, Fleischmann and Wallace (2008:370) assert that relevance 'measures the degree to which the information matches the requirements of the user'; this implies that relevance can be measured; it is relational; and it is situational, given implicit changes in the user's requirements. Vakkari and Hakala's (2000:541) more detailed definition shows relevance's situational and relational nature, and implies its non-binary nature:

> Relevance is understood as the relation between the actor's information need and the information in the documents that contribute to the solution of his or her information problem … [T]he relevance of documents is assessed by the actors in terms of their support and contribution to a certain task. This view of relevance can be called situational or task-embedded.

Hjørland (2000a) claims that non-relevance is easier to define than relevance and lists eleven examples of situations in which a user would judge a document to be not relevant. An approach emphasising non-relevance may more accurately reflect where most of our cognitive effort is directed in relevance/non-relevance judgements, especially if Baran and Davis (2006) are correct when they assert that, in our screening out of irrelevant information, we mostly avoid information.

Saracevic (2007a) puts aside as naïve the question of what relevance is, preferring instead to focus on what the *nature* of relevance is and narrowing that focus to consider the following: manifestations of relevance; the behaviour of people in relation to it; and what its influences are. For Saracevic (2007a:1918), relevance is about a relation between 'intangible objects (such as ideas, concepts, information) or tangible objects (such as documents, machines, processes) or a combination of both intangible and tangible objects (such as tasks, situations, responsibilities)', all of which he calls parts. Relevance, in his view, is a property of the relationship between these parts. The relationship between the parts can be measured and so relevance is also regarded as a measure of the strength of the relationship between the parts. The notion that relevance is binary in nature, that is, that a part is either relevant or not relevant, is rejected in the light of the measurability of relevance along a continuum.

Spink, Greisdorf and Bateman (1998) note that both user-oriented and systems-oriented research treated relevance as binary in nature and, even when finer distinctions of relevance were employed in studies (such as highly relevant, partially relevant, and not relevant), distinctive categories were combined into categories of relevant and not relevant when results were analysed. When researchers adopt a binary approach, Desai and Spink (2005) warn, they overlook the usefulness of partially relevant information to the seeker. Spink, Greisdorf and Bateman (1998) offer several reasons to consider the usefulness of partially relevant items to a user:

- users' perceptions of relevance may shift during the information search process (ISP);
- items may offer new information that will lead to new understandings (rather than have highly relevant material merely confirm old understandings); or
- low domain knowledge early in the ISP may cause documents to be judged partially relevant when, with increased knowledge of the subject area, they would be assessed as relevant.

Support for the claim that relevance criteria change during the ISP comes from Tang and Solomon (1998); Taylor, Cool, Belkin and Amadio (2007); Taylor, Zhang and Amadio (2009); and Vakkari and Hakala (2000).

Relevance has both an internal context, such as the cognitive and affective states of the user, and an external context, such as attributes of the situation, task or problem encountered by the user (Saracevic 2007a). Nowicki (2003:505) points to the difficulty of gauging relevance judgements: 'the criteria users employ to judge relevance are internally constructed and belong only to a user's mental and psychological state'. Relevance is dynamic in the sense that both the user's cognitive states and the task change over time (Saracevic 2007b). Bade (2007:834) underlines the dynamic nature of relevance when he conceptualises it as, 'in each and every case[,] a unique judgement fitting a given user's situation'. Relevance is inferred, with information systems creating it but people deriving it from information (Saracevic 2007a). Such inference entails selection from competing resources as the user attempts to gain the most from the search results with the least effort (Saracevic 2007a). Closely paralleling the expenditure of the least effort is the assumption of information foraging theory that someone looking for information will pursue resources that 'maximize the rate of gain of information relevant to his or her task' (Pirolli and Card 1999:646).

In the subsections of Section 2.2 below, I turn to a consideration of relevance studies in which school students have participated, before examining those related to university students and faculty. Section 2.2 concludes with attention to relevance studies in which decision making theory has featured. (In references that follow in the remainder of Section 2.2 below, the meanings of labels used by researchers for the relevance criteria that they have identified are sometimes not obvious. While I have attempted to define the less obvious labels, I hope that the reader will appreciate that space does not permit descriptions of every label to be offered here and will, if needed, consult the cited study for definitions.)

2.2.1 Relevance: School students

This section begins with reference to an important recent literature review by Tanni and Sormunen (2008) of information seeking behaviour of school and university students. It then proceeds to provide an overview of the few relevance studies in which school students have participated.

Tanni and Sormunen's (2008) literature review, focusing on students' information behaviour in relation to assigned tasks, draws attention to the paucity of research relating to the information seeking and retrieval behaviour of school students, a situation that prompted the authors to broaden the scope of their original review by including research associated with university students. Tanni and Sormunen's review is significant for its consideration of the association between information seeking style, ISP stage and relevance criteria; however, it contains very few other explicit references to relevance.

Hirsh's (1999) study is one of very few studies with an explicit focus on the criteria that school students use for assessing relevance. The ten students who participated were in Grade 5 in a school in Tucson, Arizona. Hirsh identified nine categories of relevance assessments applied to textual material: authority, convenience/accessibility, interesting, language, novelty, peer interest, quality, recency/temporal issues, and topicality.

Although Agosto's (2002) study did not focus specifically on relevance criteria, it is included here to expand the literature considered in relation to school students. Participants, twenty-two girls in Grades 9 and 10, were asked, in their evaluations of information, to consider what they liked, and did not like about websites, and what they would change about them. Implicit in such evaluations are considerations of relevance and reliability. Agosto's research questions, however, centred on attempts to examine how Simon's theories of bounded rationality and satisficing related to the decision making process of her participants; her study is, therefore, considered further in Section 2.2.4.

One of Chung and Neuman's (2007) two research questions, that to do with students gathering, selecting and organising information for their research assignments, has implications for relevance. Twenty-one students from a Maryland school participated in the study, with eight taking part in interviews. Students considered information to be relevant when it was aligned to the topic for their persuasive speeches and regularly chose material that supported their pre-existing views. Chung and Neuman (2007:1513) observed what they termed 'functional relevance' when students focused on finding the four types of information mandated in the assignment requirements. One of the students felt that relevance would be easy to judge because he had a clear idea of what he was looking for; he wanted search results to be more finely distinguished than 'relevant' and 'non-relevant', and came to an understanding of partial relevance. Students relied on systems relevance when depending on relevance ranking supplied by Web-based sources (Chung & Neuman 2007:1511):

> Students believed that the electronic sources performed the intellectual tasks that they had to do for themselves with print sources: filtering through and sorting out the relevant information was perceived as the biggest advantage.

Although relevance did not feature in her central research questions, Gross (2004) observes that only the older elementary school students (those in Grades 5 and 6) noted issues related to relevance. In her qualitative study, four students were at these grade levels; they noted frustration in the following circumstances:

- when they could not find information that precisely matched their search;
- when they had to select relevant information from a considerable amount of material;
- when key terms used in class did not closely match those in retrieved material; and
- when they had to consult many sources to find small amounts of the required relevant information.

Other studies of school students' information seeking behaviour that refer to relevance, but in which relevance has not been a focus in research questions, include Fidel, Davies, Douglass, Holder, Hopkins, Kushner, Miyagishima and Toney (1999); Gordon (2000); and Heinström (2006).

The project undertaken by Ladbrook and Probert (Ladbrook 2010; Ladbrook & Probert 2011) focused on students' out-of-school reading and teacher in-school reading choices. Their work, however, also sheds light on both relevance and reliability judgements. Among the Year 10 students (aged 14) in their focus groups, a common strategy was to select the first site retrieved in a *Google* search, demonstrating a reliance on relevance judgements made by an information system; however, the groups also acknowledged that they sometimes used the snippets in their search for keywords, and that sometimes they selected the second or even third result (fewer than one-fifth of respondents selected the third result) but the students went no further than that. Students scanned and skimmed information, examining subheadings and illustrations for potential relevance to their information needs. Ladbrook and Probert's (2011) findings in relation to reliability judgements are considered in Section 2.3.1 below.

Walraven, Brand-Gruwel and Boshuizen's (2009) study focused on the information evaluation criteria used by twenty-three Dutch students (aged 14) when completing school assignments. Participants most commonly considered titles and summaries when deciding on relevance; whether students found the information usable or not depended on its connection to their topics, thus making the content of sources a prime criterion. The conclusions drawn by Walraven *et al.* about students' reliability criteria are outlined in Section 2.3.1 below.

This section has revealed that very few studies with school participants have addressed relevance judgements explicitly. A small selection of studies in which relevance has been examined implicitly was included; some of these studies are in the broader field of information evaluation, which I view as encompassing relevance and reliability judgements. The following section considers studies of relevance judgements made by university students and university faculty.

2.2.2 Relevance: University students and faculty

The review by Tanni and Sormunen (2008), of information seeking literature in relation to students, noted that school students participated in few studies. Similarly to those authors, I have thus broadened the scope of my literature review to include university students in an attempt to provide a fuller picture of relevance.

2.2.2.1 Order of results: influence on relevance judgements

Several researchers have noted that the order of results influences the relevance judgements of users (Currie, Devlin, Emde & Graves 2010; Ladbrook 2010; Ladbrook & Probert 2011; O'Brien & Keane 2006; Pan, Hembrooke, Joachims, Lorigo, Gay & Granka 2007). They generally indicate specifically that students use the relevance rankings of *Google*, as demonstrated by the typical practice of an information system, in response to terms entered by the searcher, of ordering results from most relevant to least relevant, according to the inbuilt algorithms of the system.

In order to investigate the effect of order of results returned by a search engine on the perception of relevance of information sources, O'Brien and Keane (2006) manipulated the order of results that had been prejudged by ten raters to have high relevance, moderate relevance, and low relevance. Lists of results were presented in a plain text interface or using a *Google* interface, with manipulations of relevance and position for each interface. The researchers found that results at the top in the lists were favoured by the forty university students; for example, a highly relevant link, when presented first in a list of results, was chosen 83 per cent of the time, but when the same link was presented as the tenth in a list, it was chosen on 43 per cent of occasions. The study indicates the impact of search engine algorithms on perceptions of relevance; its authors note that the phenomenon of selecting items near the top of a list occurs with all lists.

In a study related to that of O'Brien and Keane (2006), Pan *et al.*, (2007) manipulated results returned by Google by using a proxy server that 'swapped' or 'reversed' results, or left them 'normal', before they appeared on the screens used by their undergraduate student respondents. Pan *et al*. found that students trusted what appeared to them to be relevance rankings provided by *Google* 'more than their rational judgments based on the evaluation of different alternatives' (2007:online).

2.2.2.2 Naturalistic studies of relevance

In naturalistic studies of relevance, the relevance criteria actually used by participants in their spontaneous judgements of information are revealed. By contrast, in laboratory studies, participants are supplied with a list of relevance criteria and requested to rate information sources against the provided list, often having also been given a set of information sources. In laboratory studies, relevance ratings of information have also been made, typically by information experts, prior to the investigation; in such an approach, the information need has also been predetermined, so that participants' ratings may be compared to those of the experts. In this section, I focus on naturalistic studies, leaving laboratory studies for later consideration.

In Tang and Solomon's (1998:255) intensive case study of a graduate student, there was variation in the informant's relevance criteria as she progressed through the ISP 'in response to the growth in sophistication of her knowledge structure within the constraints of her class assignment'. In another study focused on a small number of academics, Anderson (2006) applied ethnographic research methods to investigate the relevance assessments of two senior academics who were using subscription databases via their university as well as other Internet-based information sources ('informative artefacts' [2006:8]). The two participants were engaged in their own research projects, thus making Anderson's study a naturalistic one that focused on the spontaneous processes employed. Participants used their knowledge of authors, titles of journals, and genres to determine relevance; particular words, or combinations of words, also acted as triggers of potential relevance.

Published in the same year as the Tang and Solomon (1998) study is Wang and Soergel's (1998) study, in which eleven professors and fourteen graduate students participated. Also a naturalistic study, in that the information needs of the professors and students arose from their

academic pursuits, rather than being imposed queries, the researchers retrieved documents on behalf of their participants, based on an interview about those needs. A prepared coding scheme, however, was used in the content analysis of the data, as opposed to relevance criteria being derived from a content analysis. The researchers developed a model of document selection that took into account the processing of *document information elements*, the combination of these elements with *criteria*, and the making of a decision based on *values*. In their model, *document information elements* included title, author, abstract, journal, series, date and type; *criteria* included topicality, orientation, quality, novelty, availability, authority, and relation; and *values* included epistemic, functional, conditional, social, and emotional dimensions. Finally, the model provided for decision outcomes of acceptance, rejection and a 'maybe', thus encompassing a non-binary approach to relevance.

In Wang and White (1999), the authors propose a model of document use, which revised and expanded the model of document selection discussed by Wang and Soergel (1998). Their model of document use shows three stages of the ISP at which decisions are made: selecting, reading, and citing. Wang and White (1999) identified fourteen new criteria to add to those revealed in the Wang and Soergel (1998) study:

- cognitive requisite (the information required to comprehend the topic under investigation);
- actual quality (in contrast to expected quality);
- depth;
- classic/founder (the first substantial work in an area, or work reported by original author);
- publicity;
- reputation;
- prolific author;
- journal spectrum;
- peer review;
- standard reference;
- judge (the individual evaluating the information seeker's final product);
- norm (conformity to perceived practice for the final product);
- target journal; and
- credential (noting a work authored by the participant).

Vakkari and Hakala's (2000) longitudinal case study of the relevance criteria of eleven Finnish students undertaking Master's degrees may be considered naturalistic for using student-selected search tasks and for examining criteria that arose from the data. The researchers' central interest was in the changes that may take place in relevance criteria at three points in the students' ISP (pre-focus, focus, and post-focus); their exploratory study thus also shed light on the influence of task stage on relevance criteria. Vakkari and Hakala observed the use of six categories of relevance criteria: information content, sources of document, the document as physical entity, user's situation, user's experience and preferences, and information types. The subcategories of each of these six categories are listed in Table 2.1. Not surprisingly, topicality, at all three points in the ISP, dominated the criteria students used; for the authors, this established topicality as an essential condition for closer examination, which may culminate in acceptance, or rejection, of the information source: 'a kind of basic criterion to be fulfilled so that other ones would be worth considering' (Vakkari & Hakala 2000:553). Second to topicality came interest, which increases as the ISP progresses; the authors associate this with a decrease in uncertainty. During the ISP, there were changes in the category of 'information types', with students, for example, seeking general information early in the ISP and then preferring specific information subsequently. Vakkari and Hakala's study supports the notion that, as students make progress towards the completion of their tasks, there are changes in their relevance criteria, suggesting that they are able to 'form a more focused and differentiated construct of their research problem' as they progress (2000:557).

Categories of relevance criteria	*Subcategories of relevance criteria*
Information content	Topicality Point of view Recency Discipline Geographical area References Examples Clarity Research approach
Sources of document	Person's relation to sources Source type Author
Document as physical entity	Availability Length
User's situation	Time constraints Stage of the process
User's experience and preferences	Ability to understand Language Interest Novelty Saturation
Information types	General information Specific information Theories Methods Empirical results

Table 2.1: Relevance criteria from Vakkari and Hakala (2000:552)

Twait (2005) investigated whether the academic level of university students influenced relevance criteria and source format preferences, respectively: seven participants were first-year university students (approximately 18 years old); two were sophomore university students (approximately 19-20 years old); three were junior university students (approximately 20-21 years old); and three were senior university students (approximately 21-22 years old). Twait maintained the authenticity of the search context by recruiting students whose assignments required library-related research, that is, tasks were not contrived by the researcher for the purposes of the study. Fitzgerald and Galloway (2001:993) argue that 'The primary means of attaining authenticity was requiring participants to pursue their own topics of interest during the research session'. Twait's (2005) naturalistic study found that content was the most important criterion for all students. Familiarity followed as the next criterion of importance, and, behind that, the reputation or credibility of a source. Following reliability/credibility, were the criteria of convenience, format/type, and external influence. Cost and accuracy/validity were given low rankings. Senior students referred to content more

often than students of other academic levels, while sophomores favoured familiarity more than other student levels. Students did not rely solely on the most convenient source when selecting information, a finding that differs from that of Warwick, Rimmer, Blanford, Gow and Buchanan (2009; see Section 2.2.4). Twait's (2005) study is clearly focused on document selection criteria, and these encompass both relevance and reliability judgements, although the researcher has implicitly subsumed reliability within the construct of relevance.

2.2.2.3 Assigned information tasks

A group of relevance studies investigating students and faculty in universities and other tertiary education providers have employed information sources that participants have not spontaneously selected for themselves but have been provided for them by the researchers. Occasionally, such information sources have been modified in some way for research purposes.

Barry (1994) presented fifteen preselected documents to eighteen students and faculty from a university in the United States of America. Barry's participants used criteria related to the information content of the presented documents. Six other groups of criteria related, respectively, to the user's previous experience and background; the user's beliefs and preferences; other information and sources within the information environment; sources of documents; the document as a physical entity; and the user's situation. The study's influence on subsequent studies, particularly their use of criteria from Barry's seven groups as *a priori* criteria against which to judge relevance, make the criteria within each of the seven groups noteworthy (see Table 2.2).

Criteria groups	*Criteria*
The information content of documents	Depth/scope Objective accuracy/validity Tangibility Effectiveness Clarity Recency
The user's previous experience and background	Background/experience Ability to understand Content novelty Source novelty Stimulus document novelty
The user's beliefs and preferences	Subjective accuracy/validity Affectiveness
Other information and sources within the information environment	Consensus External verification Availability within the environment Personal availability
The sources of documents	Source quality Source reputation/visibility
The document as a physical entity	Obtainability Cost
The user's situation	Time constraints Relationship with author

Table 2.2: Relevance criteria from Barry (1994:154)

Another study of undergraduate and graduate students to whom search tasks were assigned, rather than who selected their own tasks, is Xu and Chen's (2006). Using a semi-controlled survey method, they collected data from 132 students attending a Southeast Asian university. Participants were asked to evaluate two documents, using a given set of questions. Drawing from extant literature, the researchers identified five key criteria related to relevance judgements: topicality, novelty, understandability, reliability, and scope. They have clearly subsumed reliability in the construct of relevance. Xu and Chen (2006) found that topicality and novelty were most significant, with understandability and reliability less significant in the process of relevance judgement, which is perhaps more appropriately document evaluation.

Another study drawing on university groups is the exploratory study by Taylor, Zhang and Amadio (2009), which investigated a group of 39 undergraduate students in the United States of America. The students were assigned a research question and used an online information search service; they were asked to note the relevance of each of ten journal articles; the criteria applied to make their relevance judgements; and the stage of their ISP. The intention of the authors, in assigning a research question in an area unfamiliar to their respondents, was apparently to control for prior knowledge, which they were concerned may influence the relationship between relevance criteria and ISP. The researchers found eleven criteria, with no single criterion used more commonly than any other:

- clarity of presentation;
- ability to understand;
- depth/scope;
- precision;
- specificity;
- amount of information;
- interest in topic;
- instructional;
- recency;
- authority of author; and
- bias of author.

They found that ability to understand, clarity, and recency were related to the focusing and browsing stages of the ISP. Taylor, Zhang and Amadio (2009) indicate clearly that relevance criteria are associated with ISP stages and that the importance attached by students to particular criteria changes during their ISP. Specifically, the criteria of ability to understand, clarity, depth/scope, precision, and specificity became more important to students as their ISP proceeded.

A prior study, by Taylor, Cool, Belkin and Amadio (2007), also focused on changes in the application of criteria as participants' ISP progressed. Such a focus introduces time as a variable and is based on the notion that relevance judgements are dynamic. The Taylor *et al*. (2007) study contributed to our understanding of the cognitive processes in relevance judgements by acknowledging the role played by the searcher's prior knowledge and beliefs. By so doing, the study encouraged the view that relevance judgements encompass not only properties of a document and 'the quality of the source of the document (reputation, visibility, authority)' (2007:1073), but also include subjective and contextual elements. The researchers found a statistically significant relationship between the criteria of specificity and source novelty at the writing stage.

Currie *et al*. (2010) used a hypothetical task as the basis of their observation of the evaluation criteria used by a group of ten undergraduate students at a university in the United States of America. Participants were asked to use *Google* and an online database to which their library subscribed; two of the required three sources would need to be scholarly. Of their 27 *a priori* evaluation criteria, only one, accuracy, was not observed; some of the more common criteria were: credible source, bibliography/references/cites others, balance, objectivity, content, scholarly/professional, and currency/publication date. Currie *et al*. (2010) combined relevance and reliability criteria, grouping them as evaluation criteria.

Maglauglin and Sonnenwald (2002) offer a useful approach for researchers to limit the number of documents examined by participants without removing the spontaneity of a genuine information need: they interviewed participants before they were asked to make relevance judgements and ensured that, on behalf of their participants, they found a minimum of 20 documents related to their information needs. Such an approach appears an effective way of removing the contrived assigning of tasks to participants, thus closely replicating an everyday information seeking task. Personal information needs that arise spontaneously during an individual's life are more likely to provide a research situation in which the individual is motivated and thus increase the chances that the individual will apply relevance criteria that would be used in an authentic situation.

2.2.2.4 A priori relevance categories

In contrast to studies in which the spontaneous assessments of participants have been captured, some researchers have developed relevance criteria for their participants and asked them to use these as a checklist against which to rate their relevance judgements. I refer to the latter category as studies using *a priori* relevance categories, and have referred to the example of Currie *et al.* in Section 2.2.2.3 above.

Taylor's (2012) study was naturalistic in the sense that the 80 undergraduate student participants were able to select their own topic from a list of topics related to their course; however, participants were required to choose from a given set of criteria when making relevance judgements. Taylor (2012) subsumed information quality in relevance judgements, including such aspects as bias, recency, reputation of author and source, and accuracy.

The evaluation criteria used in Currie *et al*.'s (2010) study were formulated before observation of the undergraduate participants in order for the researchers to use these criteria as a checklist against which to make their observations. Choi and Rasmussen's (2002) study is another example of the use of *a priori* relevance categories. Participants in their study were limited to using images from prescribed sources. Likewise, Cosijn (2006) used relevance criteria discovered by other researchers to develop a questionnaire; in this case, the criteria of Barry and Schamber (1998) and Vakkari and Hakala (2000) were used. Cosijn's study of graduate and undergraduate students and academics found 'a relationship between some of the relevance judgements within different work task domains' (2006:24), that is, that the use and evaluation of information varied according to the context in which the information task was undertaken.

The investigatory method of Tang and Solomon (2001) represents an interesting use of both an experimental and a naturalistic study in an attempt to exploit the benefits of the respective approaches. In their experimental approach, they employed *a priori* categories and preselected documents for their 90 undergraduate respondents to assess. In their naturalistic study, nine PhD students selected their own information sources, and used their own individual and personal relevance criteria. A comparison of the two sets of results showed 'a remarkably different change pattern both at the micro- and at the macro-level' (Tang & Solomon 2001:680), by which they mean at the level of individual criteria and categories of criteria, respectively. Building on their pilot study (Tang & Solomon 1998), the researchers adopted record evaluation as Stage 1 and full-text evaluation as Stage 2, and examined relevance criteria, both as individual criteria and as categories of criteria. They aimed to compare and contrast the respective use of individual criteria and categories of criteria between Stage 1 and Stage 2 of document evaluation. Tang and Solomon (2001) note that comparisons were made difficult by the different measuring units used in the respective laboratory and naturalistic studies; the laboratory study participants rated the importance of criteria, whereas the frequency of use of criteria by participants was measured in the naturalistic study. Participants in the naturalistic study identified 89 criteria, with *newness*, *informativeness*, and *interestingness* of considerable importance.

Participants in the laboratory study of Tang and Solomon (2001) were given fifteen relevance criteria, clustered in three groups (topicality, information quality, and cognitive state), and asked to rate their importance when evaluating records and full-text sources; all three groups of criteria were rated highly during Stage 2 evaluations. The researchers proceeded to propose a taxonomy of four categories of relevance criteria: primary objective, primary subjective, secondary objective, secondary subjective. The two objective categories are related to the document, while the two subjective categories are related to the user. Primary criteria are considered to be essential to relevance judgements, while secondary criteria are seen as factors that support the decision making process.

The use of *a priori* relevance categories and the use of pre-selected sources for participants leave open such questions as 'Did *a priori* categories restrict participants by not permitting them to use categories that they would have normally used?' and 'Did constraints on sources of information lead to a failure to uncover any criteria that would have been used, had participants been permitted to use sources that they had personally chosen?' I consider an approach using *a priori* categories to be potentially limiting, as it does not capture the natural, everyday information seeking behaviour of participants. Similarly, the provision of information sources to participants may restrict the range of sources that participants may have used, and therefore has the potential to reduce the range of relevance criteria that would be applied in an authentic information seeking episode.

2.2.3 Relevance: Other user groups, including users of health information

Most relevance studies considered above have a connection to a formal learning setting. Researchers, however, have investigated relevance in other settings, particularly where individuals have sought health information; for example, everyday life information seeking (ELIS) has also been investigated. Studies of this nature are outlined in Table 2.3.

Study	***Focus***	***Participants***	***Findings***
Chu (2011)	Relevance criteria, using topics provided by TREC (Text REtrieval Conference) 2007 Legal track interactive task	Nine doctoral students	Topicality and specificity were dominant relevance factors
Crystal & Greenberg (2006)	Relevance criteria used by users of environmental health information when searching for Web documents	Twelve individuals from a university and a local community, apparently in the United States of America	Content analysis revealed participants depended heavily on a few criteria from eight categories: affiliation, authority/person, data, influence, methodology, scope, topical relevance, and Web characteristics.
Kim & Oh (2009)	Relevance criteria applied by question askers	Question askers who were evaluating information supplied by answerers on the *Yahoo! Answers* website	Six categories: content, cognitive, utility, information source, extrinsic, and socioemotional
Ruthven, Baillie & Elsweiler (2007)	Influence of assessor's knowledge of search topic on relevance judgements	TREC (Text REtrieval Conference) assessors	Interest, knowledge, and confidence of the assessors of relevance influenced their judgements
Savolainen & Kari (2006)	Relevance judgements of Web searches for purposes of everyday life information seeking (ELIS); relevance criteria used in self-assigned search tasks of personal interest	18 participants originally, but then narrowed focus of data analysis to combination of four university students, and five other informants, whose occupations included fields of architecture, engineering and project management	18 relevance criteria, six overlapping with Barry and Schamber's (1998) criteria: accessibility, affectiveness, clarity, currency, specificity and validity. A further 12 added to these six: ability to understand, cost, curiosity, familiarity, language, novelty, reliability, security, time constraints, topicality, usability, and variety.

Table 2.3: Selected relevance studies not primarily concerned with formal education

2.2.4 Relevance and decision making theory

This section attempts to survey literature in which information seeking behaviour, particularly relevance judgements, has been related to decision making theory. My intention is to demonstrate that such links are not widespread and, when made, are sometimes quite broad and have not been made with respect to school students. There is, thus, room for a study that investigates, in greater depth, the information seeking behaviour of school students through the lens of decision making theory.

A few relevance studies have referred to decision making theory, and not all of these have discussed their findings in relation to decision making theory, or at least not in any depth. Of course, decision making theory has been considerably elaborated since the late 1990s, and thus some of the current level of detail was not available to the earlier studies.

Wang and Soergel (1998) attempted to relate relevance judgements to decision making with their observation that the following decision rules were used: *elimination*, *multiple criteria*, *dominance*, *scarcity*, *satisfice*, and *chain*.

Decision Rule	***Usage***
Elimination	All participants used a criterion for quickly rejecting a document
Multiple criteria	More than one criterion was used to decide on whether to accept or reject a document
Dominance	Participants noted an overriding aspect, such as that the item was similar to another that they had already seen and so could be rejected
Scarcity	A relatively low number of documents on a topic was retrieved and the participant lowered his or her standards of relevance
Satisfice *	The participant had retrieved a sufficient number of topic-related documents and termination of the search was near, thus rendering even relevant documents no longer useful to satisfy an information need
Chain	The participant noted a set of documents that were related to each other; for example, a set of documents consisting of the original article and those published in response to it, and documents in a single collection on a similar topic

** Agosto (2002:17) refers to 'satisficing', an amalgam of the words 'satisfying' and 'sufficing', to mean the act of 'choosing decision outcomes that are good enough to suit decision makers' purposes, but that are not necessarily optimal outcomes'.*

Table 2.4: Decision rules and their application from Wang and Soergel (1998)

Elimination, multiple criteria, and chain were the most commonly used decision rules. (See also Section 2.2.2.2 for further details of this study.) In the second part of their research project, Wang and White (1999) found support for Wang and Soergel's (1998) six decision rules and did not identify any additional ones.

In the Pan *et al*. (2007) study, the tendency of undergraduate students to trust the relevance rankings of *Google* was explained by its authors in terms of decision making theory, albeit briefly. The researchers alluded to the use of trust as a means of reducing cognitive load in decision making, referring to such use as 'a fast and frugal heuristic that exploits the regularity of the information environment' (Pan *et al*. 2007:online). Their investigation of the effectiveness of such a heuristic is of interest: if the first abstract had been selected each time in the experimental conditions, this would have resulted in the selection of the most relevant abstract in 43 per cent of cases anyway. This observation is consistent with the claim that there is no attendant loss in the quality of a decision simply because it has been made fast and frugally:

> … the bounded nature of human cognition can, in certain environments, give rise to advantages in terms of frugality and speed of the decision process without suffering any concurrent loss in the accuracy of judgments and decisions. (Newell, Lagnado & Shanks 2007:39)

The naturalistic study of ten undergraduates by Fitzgerald and Galloway (2001) focused on students' cognitive processes during their evaluation of information drawn from a virtual library of scholarly databases. Their study focused on the interaction of relevance with evaluation and decision making. The authors view evaluation as a sophisticated skill of critical thinking that is characterised by the application of criteria and values. They consider a decision to come at the end of a process that entails judgements about the relevance and quality of information. Fitzgerald and Galloway (2001:992) agree that a prime aim of critical thinking is 'to enable the thinker to make a decision in order to choose a course of action'. Their study established that students used relevance-related reasoning strategies that involved the consideration of factors such as specificity; interest; helpfulness; ability to arouse curiosity; relationship to prior knowledge; divergence; and serendipity. Evaluative strategies

included choosing the most persuasive argument, examining assumptions (premises), and examining the sequence of arguments leading to the conclusion.

The authors grouped the evaluative strategies they observed (see Table 2.5).

Category	***Participant behaviour***
Conceptual	Considers the ideas in a piece of information
Concrete	Notices obvious (but often important) quality-related characteristics of information
Empirical	Draws upon knowledge of research techniques
Metacognitive	Chooses or regulates strategies
Interactive	Draws upon some element of self to evaluate the information; such as prior knowledge or opinion

Table 2.5: Fitzgerald and Galloway's (2001:1002) grouping of evaluative strategies

The researchers observed three mechanisms by which decisions to choose documents were made (see Table 2.6).

Mechanism	***Strategy***	***Percentage application***
No objections	A decision was made to accept the information after no reason for objection was found	25%
Single strategy override	Several reasons may be stated for a decision but a single strategy overrode the others and led to a decision	61%
Balancing	Participants balanced strengths and weaknesses of the information before coming to a decision	10%

Table 2.6: Three mechanisms for making evaluative decisions (Fitzgerald & Galloway 2001)

Several relevance researchers, situating their work in the field of decision making, refer to satisficing behaviours (for example, Agosto 2002; and Wang & Soergel 1998). A more recent instance is Warwick, Rimmer, Blanford, Gow and Buchanan (2009). While a study of the development of expertise in information seeking over time, the Warwick *et al*. study is distinguished for uncovering a wider range of satisficing behaviours than seen before. It is included here to illustrate that students are seeking relevance in sources that they find most convenient. Their use-in-context approach meant that participating students, who were thirteen information management undergraduates, chose their own topics from their courses

of study. All students (except one, a 47-year-old) were in the 18- to 22-year-old range at the start of the longitudinal study; they had been raised in a range of countries: Hong Kong, the United Kingdom, Vietnam, China, Taiwan, and Korea. Researchers noted a reluctance to use the library unless its use for coursework was mandatory. Participants considered books 'less interesting, less fast, and less enjoyable than using Web-based information' (Warwick *et al*. 2009:2407). The authors observed that students used their existing skills to find enough information in the shortest possible time; they called this 'strategic satisficing' (2009:2409). It was common for students to make initial use of Web-based sources such as *Wikipedia* to 'understand the questions, locate background information, and find definitions of terms' (2009:2410). The researchers noticed in participants a 'lack of confidence in their ability to process and evaluate the information that they had found' (2009:2410). Students exhibited what the authors termed 'avoidance of interpretation' when they found the process of reading, evaluating, and comparing print information more challenging than these activities with Web-based information. The new insight related to satisficing behaviours, then, is that they are applicable to the context of developing expertise; it was only when tasks required skills and strategies not already possessed by the students that they set about attempting to develop such skills and strategies. Warwick *et al*. (2009:2414) observed, among the students, 'considerable ingenuity in finding ways to avoid or limit complexity'.

Berryman (2008b) studied the decisions of public sector policy and research workers in Australia, focusing on when they decided that they had enough information to meet specific information needs in the workplace. Her research may be considered to have emphasised participants' decisions that they had sufficient *relevant* information. Several of Berryman's findings were consistent with the tenets of NDM (naturalistic decision making), which she noted is a relatively recent development in decision theory. Agosto (2002:24) refers to the appearance of repeated information as 'information snowballing'. In Agosto's study of twenty-two female students aged 14-16, information snowballing was associated with satisficing or, more specifically, termination: having found an acceptable choice, the participants concluded their Internet searching.

Although lacking a strong emphasis on the phenomenon, relevance nevertheless features in the conceptual framework of Tang (2009) when the author refers to: (a) individuals' tendency to base relevance judgements on partial information; and (b) Brunswick's Lens model, a decision making theory that incorporates the use of cues by the information seeker to 'infer

the intellectual contents and relevance of a work' (2009:941). One of the researcher's questions related to the weighting given by participants to each information cue; these cues may be thought of as relevance cues. Reference to Tang's (2009) study here is intended to illustrate a recent application of decision making theory to an information seeking context; however, it showed that cues used by library patrons seeking titles (thus, cues of sources that may be relevant to information needs) were commonly: (a) the following up of titles in footnotes, and (b) the recommendations of acquaintances. Tang (2009:951) argues that these are 'cues with high validity and relatively low acquisition cost'.

While the studies referred to in this section have taken into account selected tenets of decision making theory, none of the studies' participants were school students, leaving the field open for an investigation that considers the potential of decision making theory to feature in explanations of such a group's relevance judgements.

2.2.5 Relevance studies summed up

Studies of relevance judgements in schools and in higher education show that topicality is an important criterion, along with order of results, novelty, and depth. Tertiary students, however, are more likely to use their knowledge of authors, journal titles, abstracts, and genres. Currency of information, and the presence of a bibliography or references, also seem of greater interest to students in higher education. In non-educational settings, factors such as affectiveness, and a socioemotional dimension, influence perceptions of relevance. The current investigation will examine the criteria applied by students when making relevance judgements; for example, it will consider topicality, influence of order of results from a search engine, reputation of information provider, and the role of references, as well as other criteria not uncovered in previous studies of secondary school students, an understudied group.

2.3 Studies of reliability

This section of the review considers literature related to credibility, reliability, accuracy, authority, quality of information and trust in information. I have grouped these six terms, considering them to refer to near-synonymous constructs, in order to overcome definitional difficulties. Rieh and Donaldson's (2007) literature review notes that information science generally conceptualises credibility as a subset of relevance judgements. Several studies have subsumed reliability in the construct of relevance, including Maglaughlin and Sonnenwald (2002), Savolainen and Kari (2006), Twait (2005), and Xu and Chen (2006). Similarly, Rieh's (2002:147) selection of literature suggests that relevance judgements, also include such criteria as 'quality, authority, reliability, coverage, depth/scope, and novelty', in addition to encompassing topicality. Other studies, such as that of Currie *et al*. (2010), have combined elements of relevance and reliability in the broader category of information evaluation.

Having reviewed the literature, Hilligoss and Rieh (2008:1468) conclude that, while there is no single definition on which there is wide agreement, credibility is understood to mean 'believability, trust, reliability, accuracy, fairness, objectivity, and dozens of other concepts and combination thereof'. They also noted that the construct is variously conceptualised in relation to 'characteristics of persuasive sources, characteristics of the message structure and content, and perceptions of media' (Hilligoss & Rieh 2008:1468). The authors distinguish credibility judgements from credibility assessments (assessments are made in a process of iterative judgements), and developed a framework of credibility assessment that took into account a wide variety of information seeking contexts, including those related to work, school, university and personal pursuits. Their model, reproduced in Table 2.7 below, presents three interdependent levels of credibility assessment: construct, heuristics, and interaction.

Level	***Definition***	***Types***	***Influence***
Construct	Conceptualizations of credibility	Truthfulness Believability Trustworthiness Objectivity Reliability	Provides a particular point of view for judging credibility
Heuristics	General rules of thumb that are broadly applicable to a variety of situations	Media-related Source-related Endorsement-based Aesthetics-based	Provides useful ways of finding information conveniently and making credibility judgment quickly
Interaction	Specific attributes associated with particular information objects and sources for credibility judgments	Content cues Peripheral source cues Peripheral information object cues	Provides specific information source or object characteristics on which to base a judgment

Table 2.7: Hilligoss and Rieh's (2008) model of credibility assessment

Wathen and Burkell (2002) cite sources that use credibility to mean believability, and that describe credible sources as trustworthy and having expertise. Kelton, Fleischmann and Wallace (2008) consider reliability and confidence as narrower concepts than trust, emphasising the subjectivity of the information seeker. Robins, Holmes and Stansbury's (2010:14) definition of credibility also suggests its subjectivity: 'the perception of trustworthiness, believability or expertise perceived in the stimuli shown to subjects'. For the purposes of their study, Robins and Holmes (2008:387), had previously defined credibility as 'the extent to which users trust the informational content on a website'. Xu and Chen (2006:964) define reliability as 'the degree to which the content of a retrieved document is perceived to be true, accurate, or believable'. They hypothesised that reliability was positively associated with relevance but found a relatively weak influence (novelty and topicality being the strongest relevance criteria).

Relevance assessments appear to precede any tests of reliability, that is, users will generally not check a piece of information's reliability unless they have first established that its relevance to their needs. An example of an exception to this may be when a user notices a '.com' suffix in a search result before making a judgement of a source's relevance, and then rejects that result because of a preconception that information from such sources is unreliable.

Xu and Yin (2008) argue that topicality is the prime criterion used in making a judgement of a document's relevance and that, without topicality, the application of other criteria, such as novelty, understandability, reliability, and scope of the document, are inapplicable, as documents regarded as non-topical will be discarded by the user. Educators exhort their students to evaluate the credibility or reliability of information they find; it is assumed that generally they will evaluate relevant information. Various criteria are proffered for them to apply. Having reviewed the literature, Metzger (2007:2081), however, has found that 'these models [of credibility evaluation] have not been directly connected to studies examining what factors people really do use to determine credibility online'. With the major exception of Wathen and Burkell (2000), few authors have synthesised research findings to describe the process people use when assessing the reliability of online information.

Corroboration is a prime means of establishing reliability and may be construed as the active searching out of redundancy. Candy (2004:87) refers to 'corroboration' to mean 'looking for supporting information, or triangulation, in other sources'. Meola (2004) recommends it as part of an information evaluation strategy. Chung and Neuman (2007) found that students often chose information that accorded with their own views. Kelton, Fleischmann and Wallace (2008:369-370) view trust in information as broader than reliability of information and refer to a process of identification, which 'reflects the degree to which the information contained within a source conforms to the user's own identity, goals, and values'. They claim that trust in the information is 'enhanced if the user resonates with the style, arguments, or objectives presented' (*ibid.*). The tendency to seek information that conforms to one's existing point of view is also supported by Seamans's (2002:116) finding that all students in a sample of nine undergraduate students in an English class set out with a 'predetermined viewpoint they were looking to support, as opposed to more broadly exploring a topic'.

In addition to corroboration, users may employ other means of establishing reliability, including authority; Hirsh (1999:1272), for example, defines authoritative text as text that 'contains expert and reliable information'. Few of the young students in the Hirsh study, 2 per cent, referred to authority. Hirsh suggests that students at the concrete-operational stage in their development are unlikely to have acquired the skills required to evaluate the authority of information.

The authority of the author is often given high prominence in guidelines to use when evaluating information sources; for example, Robinson (2000); and Dieterle, Richmond, Markgraf, Kasuboski, Piele, Cardinal, Olson and Zillner (2000), whose second of ten criteria is credibility, which includes the reliability of the author. Wang (2007:599) places much faith in the use of standard evaluation guidelines but does not justify the claim that 'When students substitute objective evaluation guidelines with subjective personal judgment, the quality of the information they choose is questionable'.

2.3.1 Reliability: School students

While relatively few studies of the relevance criteria used by secondary school students have been undertaken, the picture in relation to studies of reliability criteria is not quite as dismal. The greater interest among the research community in reliability studies of school students may reflect recent concerns about the quality of information accessed by students via the Internet and the potential impact of unreliable information on the learning outcomes of students.

An early study with participants of school age (Hirsh 1999) revealed that a mere 2 per cent of students considered the reliability of the information they found, although this was explained by their developmental stage. Shenton and Dixon (2003a), whose participants were 188 students ranging in age from six to eighteen years old, similarly found that few students demonstrated the use of information evaluation skills; none reported instances of evaluating credibility of non-print information. Research questions in Shenton and Dixon (2003a) do not explicitly address reliability criteria. Large and Beheshti (2002) note that few of the Grade 6 students (around 12 years old) in Montreal in their study were critical of specific resources that they retrieved.

Although the work of Ladbrook and Probert with New Zealand students (Ladbrook 2010, Ladbrook & Probert 2011) may be considered tangential to studies of reliability, nevertheless their project has contributed to our knowledge of how students aged 14 decide on the reliability of information. Around 85 per cent of teachers in their study expressed concern about the poor critical discrimination skills of students, including their difficulty in determining the authoritativeness of information. Students relied on the first listed result

returned by a search engine and based their evaluation of websites on design elements such as layout, graphics and colour. They displayed little conscious awareness of strategies to evaluate the accuracy of information, suggesting an intuitive response on their part.

As part of their study of the evaluation criteria of Dutch secondary school students, Walraven, Brand-Gruwel and Boshuizen (2009) examined their participants' reliability criteria. The researchers suggest that students rarely evaluate information explicitly and that they pay most attention to whether the information is able to solve their information need or not. Occasionally, usability of information depended on the language of the source (whether it was foreign, written in informal language, such as slang, or contained spelling errors), but information was rarely verified. Of the Web pages viewed, only 15 per cent were evaluated, by which the authors apparently mean that they were judged for their usability, verifiability and reliability. While students knew of evaluation criteria, they rarely applied them explicitly, yet demonstrated knowledge of them when these criteria were raised by the researchers. When details of the author were present in sources, this appeared to trigger the consideration of such an element in students' evaluations. Some students, however, gave higher priority to the comprehensibility of the information, connection with topic, and the corroboration of the information of one site with another.

A significant recent study of how school students make credibility assessments comes from Francke and Sundin (2009), who took an ethnographic approach to an investigation of around seventy students in Sweden who were aged from 17 to 18 years. Their study focused on students' use of genre in the context of completing schoolwork; they defined genre as 'social action', adding that 'genres shape, and are shaped by, how people act around texts as well as how they construct texts' (Francke & Sundin 2009:no pagination). User-generated websites, such as *Wikipedia* and blogs, were the focus of students' attention. Printed books were accorded higher credibility by students than websites because of the association of printed books with a publishing process that was perceived to offer quality control. Genre knowledge thus influenced credibility assessments. The ease with which user-generated resources could be created, and amateurish writing, were factors that contributed to students' lower credibility assessments. Sources offering opinions were generally considered less reliable than those purporting to offer facts. Teachers' lack of endorsement of *Wikipedia* gave rise to students' hesitation to use it. Francke and Sundin (2009) refer to the genre conflict associated with *Wikipedia*: despite its membership of the encyclopaedia genre,

traditionally viewed as reliable, it is also a user-generated source, which is a genre considered to offer opinions and to be without quality control. The authors conclude that the use of genre in credibility assessment is a blunt instrument and that, in the community of practice that is the school, sources offering opinions are rated lower in credibility than those sources that have been subject to quality control.

Sundin and Francke (2009) examine the ways in which students drew conclusions about the credibility and authority of information. Five themes emerged from an analysis of data from their thirty-seven participants, aged 17 and 18 (see Table 2.8).

Theme	***Description***
Google to *Wikipedia* link	*Google* led the searcher to a *Wikipedia* article
Forming knowledge	Students demonstrated an awareness of how knowledge was shaped
Transferred authority	Perceptions of the authoritativeness of a person or organisation were transferred to a document
Print/digital dichotomy	Print resources considered more trustworthy
Genre-based credibility assessment	Students, for example, viewed blogs as providing opinions rather than facts; treated information from *Wikipedia* with scepticism after repeated warnings from teachers about encyclopaedia's trustworthiness

Table 2.8: Credibility and authority themes identified by Sundin and Francke (2009)

In Francke, Sundin and Limberg (2011), twenty-nine upper secondary students in a Swedish school identified sources for a task and, in groups, ranked the sources according to their perceptions of the sources' credibility. Teachers gave instruction related to trust, credibility and information seeking. The students' task required the keeping of a blog in which they recorded their reflections on the process of their searching and their credibility assessments. The researchers' thematic analysis revealed eight criteria, which they referred to as strategies: authorship, references, applicability, currency, media properties, genre, rhetoric, and social commitment. The authors acknowledge the likely influence of instruction on the appearance of the first two strategies. Their analysis went further, to identify four sources of credibility judgements, which Francke *et al.* (2011) refer to as approaches: credibility from control; credibility from balance; credibility from commitment; and credibility from multiplicity. The first and the second of the four approaches were the most common. Students' use of commitment revealed an approach rarely featured in traditional checklists of information evaluation; this approach derived from students' perceptions that the organisation providing

the information was motivated by altruism: the organisation's opinions were based on a 'selfless struggle to improve living conditions for everyone' and produce the 'best for mankind' (Francke *et al.* 2011:689). Participants appeared more accustomed to searching for facts than for opinions in the context of a school task; when the task required that they find and evaluate twelve sources related to nuclear power in Europe, they were confronted by opinions and value-laden facts, information that they 'rarely viewed as credible' (2011:691).

The work of Francke *et al.* with Swedish students, and the work of Walraven *et al.* with Dutch students, cited above, represent the most important contemporary research into judgements of reliability made by secondary school students. The Dutch research indicates that a judgement that information is relevant to an information need takes precedence over any reliability judgement, while the Swedish research situates reliability judgements in the socio-cultural practice of the school. There is considerable scope for undertaking research into the reliability judgements of school students in other countries.

2.3.2 Reliability: University students and faculty

In a Web survey conducted by Lim (2009) of 134 undergraduate students at a university in the United States of America, the author focused on motivation for using *Wikipedia*, students' perceptions of it, and their uses of this encyclopaedia. The study included a focus on students' perceptions of *Wikipedia*'s reliability through Lim's consideration of information quality, which the researcher defined as 'one's evaluative judgment of the goodness of information' and which 'was measured through six items, namely accuracy, verifiability, reliability, comprehensiveness, fairness, and overall writing quality' (Lim 2009:2192). Related to this is the study's consideration, from social cognitive theory, of outcome expectation, defined by the author as 'one's expectation of information quality and the benefits to be obtained from using Wikipedia' (Lim 2009:2192). Furthermore, the study considered participants' perceptions of self-efficacy in relation to information evaluation. Results revealed that, rather than accuracy of information and trustworthiness of information drawing students to use *Wikipedia*, they were attracted to what Lim refers to as information utility. *Wikipedia*'s provision of background information, without students' expectation that the best information would be provided, but with an expectation that it would be 'reasonably good', coupled with positive experience of its use in the past, ensured that *Wikipedia* was a wanted resource.

Eskola (2005) compared a group of sixteen medical students following a problem-based curriculum with fifteen medical students following a traditional curriculum, with the intention of noting their respective information literacy development. Included in such development was their critical thinking related to the evaluation of medical information. Students reported that their teachers had warned them about the unreliability of Internet sources and had offered them lists of websites that they considered reliable. Eskola identified three categories of critical judgement of information: Rich use of sources (Category A), Simple use of sources (Category B), and Slight users of sources (Category C). More students following the problem-based curriculum were placed in Category A than students following the traditional curriculum. Students in Category A used advanced criteria to judge information, including attending to the age of the source, and to support offered for claims made in the sources. Students in Category B paid little attention to reliability of sources, while those in Category C showed the lowest incidence of evaluative behaviour.

In Liu's (2004) study, 128 students from a university in the United States of America completed questionnaires about their judgements of the credibility of scholarly information on the Web. Participants used a seven-point scale to rate twenty credibility dimensions related to information content; authorship; layout and structure; and website and usage; but were also invited to answer five open-ended questions in order to capture any aspects not covered by the twenty dimensions. Around one-third of respondents completed the open-ended section. Liu (2004:1031) found that factors positively associated with information content were: 'resonance with one's beliefs, novelty of information, trustworthiness, and good quality'. On the authorship scale, affiliation with a prestigious institution was rated more highly than whether the author was a famous expert. In relation to layout and structure, the inclusion of references raised credibility ratings, while a pleasing layout and details of the author's affiliation were also important, although less so than references, which was one of two positive indicators contributing most to a perception of credibility. In the group of dimensions referred to as website and usage, publication in a printed journal rated the highest (the second of the two most positive indicators of credibility), with the posting of a document on a well-respected website, and a link to a trusted source, considered favourably. The two most negative indicators of reliability were the presence of typographical errors and links that did not work. The open-ended section of Liu's (2004) questionnaire identified thirty-one positive criteria and twenty-five negative criteria that students employed in evaluations of credibility; several of these were similar to, and some overlapped with, the *a priori* criteria in the set of twenty questions.

Liu's (2004) study relied on self-reported data in relation to experiences with Web-based scholarly information generally, rather than to a specific set of sources to meet a specific and authentic information need.

Almost incidentally, some studies have revealed the criteria used by university students to judge the reliability of information. While focused on participants' document selection criteria, Twait (2005), referred to in Section 2.2.2.2 above, notes that reliability and credibility were important criteria for the students in the group. She found, however, that accuracy/validity was one of the lowest ranked criteria. Similarly tangential to the focus of research is Urquhart and Rowley (2007), who found that it was only after their first year of studies that undergraduates appeared to be applying such criteria as the currency, reliability, and authority of an information source. If these students were more advanced in their epistemological beliefs than younger students, possibly this finding accords with that of Whitmire (2004:109), who found that such students were 'better able to evaluate information sources and recognize authority'.

The role of design in perceptions of website credibility has been clearly demonstrated by Robins and Holmes (2008), who presented their sample of twenty graduate and undergraduate students with pairs of websites offering the same information but with two different aesthetic treatments: high (essentially, sophisticated design) and low (no significant design). The pairs of websites did not follow each other in order when presented but were randomly scattered throughout the set of forty-two websites shown to the students, who were asked to rely on their first impressions of credibility. Robins and Holmes found that websites with a high aesthetic treatment were generally judged as having higher credibility. In what they call an 'amelioration effect of visual design and aesthetics on content credibility' (Robins & Holmes 2008:397), they assert that judgement is at a visceral level and occurs within a few seconds. The researchers suggest that the amelioration effect may decrease as information users engage at a more cognitive level with the content of a website; this assumes that users have not excluded the website from further consideration on the basis of their visceral reaction. Their work leaves open the possibility of a more fine-grained analysis in which, for example, the specific elements of design could be investigated to uncover which of these lead to the visceral reactions that they observed.

2.3.2.1 Naturalistic studies of reliability

In their naturalistic study of reliability, although its authors refer to the notion as 'evaluation' (which they associate strongly with critical thinking), Fitzgerald and Galloway (2001) allowed the ten participants to select their own topic, restricting searches to a specific set of scholarly databases. The overlap with reliability becomes clear when Fitzgerald and Galloway (2001:990) define evaluative behaviour to include 'credibility, quality, trustworthiness, and usefulness of a resource'. The authors argue for a separation of the constructs of relevance, under which evaluation is often subsumed, and evaluation, on the basis that relevance rarely enters the dialogue of educators and cognitive psychologists when discussing critical thinking and judgement, and that, given the complexity of the critical thinking component of evaluative behaviour, relevance and evaluation should be taught separately. The researchers observed and labelled a variety of evaluative behaviours set out in Table 2.9 below.

Label	***Behaviour***
Good	The participant did not offer a specific reason
Context	The information item appeared in a questionable context
Methodology	Scientific method seemed sound
Perspective	Presented an alternate view
Insufficient	Information presented was insufficient to be of use
Author	Well-known, familiar, or important author

Table 2.9: Evaluative behaviour observed by Fitzgerald and Galloway (2001)

One student perceived credibility in an article in a journal that she associated with authority; and also because it accorded with her prior knowledge. Evaluative strategies used by students included a set that assessed rhetorical elements: the identification of the most persuasive argument; the examination of assumptions (premises); and the examination of the sequence of arguments leading to a conclusion. Other evaluative strategies were evident in the use of questions asked by students of the information. Fitzgerald and Galloway (2001) grouped students' evaluative strategies into five main categories (see Table 2.10).

Approach	***Including, but not limited to:***
Conceptual	Affective dimensions, complexity, scope, perspective, and logic/rhetoric dimensions
Concrete	Currency, size, language, and context
Empirical	Overall methodology, use of controls, and results of study
Metacognitive	Metastrategies, such as considering information in the light of personal experience; considering the opinions of others about a source as a means of triangulation; and using intuition as a way of sensing truth
Interactive	Personal reactions, and use of prior knowledge

Table 2.10: Evaluative strategies of students in Fitzgerald and Galloway (2001)

Rather than the laboratory setting of Rieh (2002), Hilligoss and Rieh (2008) adopted a naturalistic approach, attempting to develop a unified model of credibility assessment. They gathered data from twenty-four undergraduate students (with an average age of about 22 years) engaged in information seeking tasks of their own choice in a broad range of contexts: work, university, and everyday contexts. The authors contend that credibility research should also consider multiple media, in addition to a variety of contexts. The three levels of their credibility assessment model, that is, construct, heuristics, and interaction (see Table 2.7 above), were influenced by context, defined by the authors as follows (Hilligoss & Rieh 2008:1473):

> ...the social, relational, and dynamic frame of reference surrounding the person's information seeking process. In general, it creates boundaries around the information seeking activity or the credibility judgment itself. The context of credibility judgments can either guide the selection of resources or limit the applicability of such judgments.

Noting the role of the university context, the authors observed that a particular participant's credibility assessment was made with deference to a professor's views of the credibility of sources on the Web. Hilligoss and Rieh (2008) found four categories of heuristics were applied in students' credibility assessments (see Table 2.11).

Heuristics	***Description***
Media-related	For example, books and scholarly journal articles are more credible than Internet sources
Source-related	Familiar sources are more credible than unfamiliar ones, and primary sources are more credible than secondary ones
Endorsement-based	Source is endorsed by a knowledgeable or trusted individual, sometimes by citation
Aesthetics-based	Aesthetic design of websites influences credibility perceptions

Table 2.11: Students' categories of heuristics for credibility assessments
(Hilligoss & Rieh 2008)

In an interesting mix of a naturalistic study and one in which information sources were assigned to participating university students, Iding, Crosby, Auernheimer and Klemm (2009) report on two studies, both of which entailed students examining the credibility of information related to cleanroom software engineering. In the first study, eighty-four students in both education and computer science, working in groups as part of a class exercise, were asked to select a website that gave 'the most accurate and objective representation' of the topic and also to select a website that 'illustrates a misconception (or leads to a misconception)' in the topic area (Iding *et al*. 2009:49). Participants answered questions about the ways in which they determined accuracy; how confident and competent they considered themselves to be about credibility judgements; and the vested interests of website information providers. The major reason for website selection was the focus or relevance of the information. Next, participants were interested in sites providing educational information. After that, reasons for selection included the site's use of references, and design. When participants perceived the vested interests of information providers to be based in education, they appeared to consider these sites to be more objective and less biased than ones that they perceived as explicitly commercial, even though sites providing educational information may have been promoting the purchase of related goods and services, whether their own or those of others.

In their second study, Iding *et al*. (2009) focused on twenty-five computer science graduate students, presenting them with three websites that had been selected by participants in the first study: one obviously commercial, one obviously educational, and one a mix of commercial

and educational. The same proportion of students who considered the commercial site to be

objective and accurate also considered it purposely misleading (40 per cent). The educational site was assessed as objective and accurate by 56 per cent while only 4 per cent thought it was purposely misleading, although 20 per cent thought it 'mistaken'. The mixed site was rated as objective and accurate by 71 per cent, with 8 per cent rating it as purposely misleading. In response to a question about how they knew when information on a website was wrong, most comments from participants related to their prior knowledge, with the next most frequent category relating to corroboration (which overlaps with the former category because information may be corroborated by prior knowledge). Other reasons for concluding that website information was incorrect were based on matters such as 'poor design, bias, problems with references, non-working links, lack of clarity, inaccuracy and sales pitches' (Iding *et al*. 2009:56).

2.3.2.2 Assigned information tasks

Rieh (2002) studied the perceptions, in relation to information quality and cognitive authority, of sixteen scholars from groups of university faculty members and doctoral students. Participants were given four search tasks, for which they provided a think-aloud report while performing their searches, and were then interviewed after their searches, during which interview investigator and participant viewed a recording of computer screen activity. The investigator preferred a laboratory setting for its claimed ability to answer more research questions than permitted by a natural setting. When responses were analysed, two types of judgement were noted: predictive judgements, that is, those made before participants looked at a website; and evaluative judgements, that is, those made while participants were viewing a website. Responses were categorised as relating to information quality when participants commented on how 'good, accurate, current, useful, or important' the information was, and as relating to cognitive authority when they commented on the extent to which the information was 'trustworthy, credible, reliable, scholarly, official, or authoritative' (Rieh 2007:157).

The study of Pan *et al*. (2007) was discussed above (Section 2.2.2.1) in relation to the investigation of the effect of order of results returned by a search engine. The study is referred here both to outline its justification for its non-naturalistic approach and to link its finding on trust to perceptions of reliability. The study required the use of assigned tasks, whose search results could be predetermined, in order to investigate whether the order of abstracts or the

algorithm used by *Google* was more influential in what participants perceived to be relevant. The researchers also needed to avoid the first ten results having a similar level of relevance and so manipulated the order of results. As the authors argue, 'A laboratory setting was necessary to capture all aspects of the search sessions and related eye movements, in order to compare the variables across all subjects systematically' (Pan *et al*. 2007:online). Data sets, including of eye tracking data, were obtained from sixteen university students from a variety of disciplines.

The Pan *et al*. (2007) study is raised in the context of reliability and trust as it shows that trust may relate not only to individual sources of information but also to a gateway to information, such as the search engine *Google*; thus, a provider of information may become trustworthy in a way not too different to a book publisher becoming trusted in the traditional print world; this is referred to as media-based credibility. The student participants implicitly trusted the algorithm used by *Google* to return results in an order of relevance that coincided with their information needs. The study portrays the use of *Google* as a reliable way of finding relevant information and indicates the intertwined nature of relevance and reliability. With one of five research questions related to trust, that is, whether 'students and faculty trust search engines to provide an adequate representation of the information space in support of learning, teaching, and research', Rieger (2009:online) is in a similar category to Pan *et al*. (2007). The link between the two studies is further reinforced when Rieger (2009) relies on the definition of trust offered by Pan *et al*. (2007:online): 'Confidence in a search engine's ability to retrieve and rank results by their true relevance to a query'. Rieger's (2009) results indicate a trust in the ability of *Google* to have indexed sources so well that, if users did not find relevant results within the first one or two pages of returned results, they revised their search strategy. The implication is that precision is in the search engine and that the user must modify keywords to meet the requirements of that precision, although the author does point out that this could equally be a response to shortcomings apparently perceived in the search engine. *Google* as a brand also played a part in respondents' confidence and faith in the search engine when they referred to its 'proven track record of innovation and constant improvement of the search algorithms and crawling techniques' (Rieger 2009:online). The Rieger (2009) and Pan *et al*. (2007) studies suggest a broader notion of trust than trust that is related to specific, individual information sources; they indicate that credibility judgements are made of media types.

Currie, Devlin, Emde and Graves (2010:116) asked their ten undergraduate student participants to 'research the allegations that vaccines cause autism in children'. This study, in which relevance and reliability criteria were grouped as evaluation criteria, was referred to in Section 2.2.2.3 above; it identified 'balance, content, scholarly/professional, currency, credible source, and references/bibliography' (Currie *et al*. 2010:122) as commonly applied evaluation criteria. Some students explored the credibility of an author or source; they were aware of the sound reputation of some journals, and observed that doctors or university researchers authored some sources. Credibility was conveyed by a word like 'Harvard' in a journal title, by suffixes such as '.gov' and '.org' in URLs, and when organisations providing the information were familiar to the students. Several students displayed a lack of trust in blogs and *Wikipedia*. Three students considered *Wikipedia* and the CNN website unsuitable for their information seeking task, and one favoured library databases over Internet sources on the grounds that Internet sources were able to be 'changed randomly' (Currie *et al*. 2010:121). The researchers formed the view that students did not have a complete understanding of the concept of credibility; they seemed restricted to the use of three or four credibility criteria.

2.3.2.3 A priori reliability categories

Studies that have used *a priori* reliability criteria in order to categorise the responses of participants include those of Currie *et al*. (2010; see Section 2.3.2.2), Liu (2004; see Section 2.3.2) and Tang and Solomon (2001; see Section 2.2.2.4). While Currie and colleagues included *a priori* reliability criteria in a group of evaluation criteria, Tang and Solomon incorporated them in a group of relevance criteria. Of note is that Tang and Solomon (2001) report on two studies: one naturalistic and one experimental; in the experimental study, they offered participants *a priori* criteria of information quality. Liu (2004), although employing *a priori* reliability criteria, allowed for the generation of user-employed ones through the use of an open-ended section, thereby uncovering criteria that did not fit the categories given to participants and revealing a fuller picture of the range of criteria used.

2.3.3 Reliability: Other user groups, including users of health information

The current literature review has focused on studies with a connection to a formal education setting. However, other studies also shed light on the notion of reliability and are outlined in Table 2.12 overleaf.

Study	***Focus***	***Participants***	***Findings***
Adams, de Bont & Berg (2006)	Information search for medical or health information	18 Dutch patients aged between 20 and 60	Soft colours, large print, simple headings and bulleted points made information more understandable and influenced reliability judgements
Cader, Campbell & Watson (2009)	Judgements of reliability of nursing practice information on Web	Two groups, United Kingdom: 20 nurses in graduate course, and 13 nurses from hospital	Reliability judgements generally intuitive, quasi-rational, and analytical; cognitive processes influenced critical evaluation skills of nurses, cues on website, and time available
Carpenter, DeVellis, Hogan, Fisher, DeVellis & Jordan (2011)	Information-seeking behaviour of patients with vasculitis; in effect, investigated media credibility	Over 200 respondents	Patients rated physicians and internet as most credible sources; rated pharmacists and other vasculitis patients as fairly credible
Flanagin & Metzger (2007)	Message credibility, site credibility, and sponsor credibility	274 registered voters in United States of America and 300 undergraduate students	News organisation website and e-commerce site accorded similar level of credibility, with both genres scoring higher credibility ratings than special interest group and personal sites
Fogg, Marshall, Laraki, Osipovich, Varma, Fang, Paul, Rangnekar, Shon, Swani & Treinen (2001)	Credibility ratings of generalised experiences with Web	1,410 residents of Finland and United States of America; median age 33 years	Boosted perceptions of credibility: real-world feel, ease of use, expertise, trustworthiness, tailoring; negative influences: commercial implications, and amateurism
Fogg, Soohoo, Danielson, Marable, Stanford & Tauber (2003)	Website credibility	2,684 residents from 30 countries	Major criterion: design look; next most frequent criterion: information design/structure
Hertzum, Andersen, Andersen & Hansen (2002)	Compared and contrasted role played by trust when seeking information from people, documents, and virtual agents	Software engineers' trust of people sources and document sources (apparently 7-17 participants at each of 16 project meetings), and trust of people in virtual agents on e-commerce sites (eight participants, 24-38 years old)	People were relied upon quite considerably, perhaps because people sources were suggested to the project group more frequently than document sources

Study	***Focus***	***Participants***	***Findings***
Hughes, Wareham & Joshi (2010)	Authentic information seeking behaviour of doctors, exploring judgements of Internet information	35 doctors in United Kingdom; average age 27 years	Rarely made evaluative judgements; doctors relied on mental models of sites; models incorporated perceptions of sites' information quality and cognitive authority
Jo (2005)	Contrasted credibility perceptions of online and traditional news providers	184 undergraduates (mean age of 22.5 years)	Participants more likely to believe negative news story about an organisation published in traditional newspaper than in online news source, despite identical content; when news story about organisation was positive, participants more likely to believe online source
Kim (2010)	Judgements about credibility of answers given in context of social question and answer website *Yahoo! Answers*	All except two of 36 participants (mean age 37 years and from a variety of occupations) from United States of America	Participants used *Yahoo! Answers* because of previous positive experiences with it, indicating pre-existing perceived credibility, and to confirm information found in other sources; message criteria: accuracy, clarity, completeness, detail, fact, layout, length, logic, novelty, spelling and grammar, tone of writing, topicality; source criteria: answerer's attitude, known answerer, perceived expertise based on answer, perceived expertise based on answerer's profile, reference to external sources, self-claimed expertise or qualification.
Robins, Holmes & Stansbury (2010)	Credibility of consumer health information websites	34 participants in over-35-year-old age group, ostensibly from United States of America	Tendency that when visual design rated highly, credibility ratings correspondingly high

Table 2.12: Selected reliability studies not primarily concerned with formal education

2.3.4 Reliability and decision making theory

This section attempts to survey literature in which information seeking behaviour, particularly reliability judgements, has been related to decision making theory. My intention is to demonstrate that such links are not widespread and, when made, are sometimes quite broad and have not been made with respect to school students. There is, thus, room for a study that investigates, in greater depth, the information seeking behaviour of school students through the lens of decision making theory.

Some studies that address reliability have made links with decision making theory. The authors of some of these studies refer to decision making in broad terms that make general links to central credibility issues in their work. This may be inevitable, considering both that credibility is the focus of such studies and that decision making theory is, by its nature, a broadly applicable theory, given its explanatory power in a wide range of human endeavour. Higgins (1999), for example, focused on decision making under time constraints and made an explicit link to decision making theory in relation to our tendency to assign more weight, and thus more cognitive processing capacity, to sources that we perceive as credible.

Prabha, Connaway, Olszewski and Jenkins (2007) studied thirty-one faculty, nineteen graduate students, and twenty-eight undergraduate students. Their focus was the ending of an information search ('stopping behaviour'), which they equated with satisficing, a concept introduced by Simon (1955) and defined by the authors as 'a judgment that the information is good enough to satisfy a need even though the full cost-benefit analysis was not performed' (Prabha *et al*. 2007:76). The researchers found that university faculty used perceived credibility, or trustworthiness, as a cue to ending their information search. In their work, the researchers considered role and rational choice theories, with the latter's offshoot of satisficing. Rational choice theory was supported by students' use of potential pay-off, in terms of grade, as a guide to how much time to invest in assignment completion. Stopping behaviour was also the focus of Berryman (2008b), considered in Section 2.2.4 above.

Hilligoss and Rieh (2008) found the Elaboration Likelihood Model (ELM; Petty & Cacioppo 1986), a model from psychology to explain persuasive communication, a useful framework to explain their findings. As Hilligoss and Rieh (2008:1470) indicate, 'Heuristics are practical rules or guidelines that aid in problem solving, decision making, and discovery … and as such tend to reduce mental effort'. ELM's systematic and heuristic processing of messages, respectively, essentially parallel decision making's analytical and intuitive modes of cognition. Peripheral cues from sources and messages are used in heuristic processing, in contrast to the use of content clues in the more effortful systematic processing. The Hilligoss and Rieh (2008) study, discussed in some detail above in Section 2.3.2.1, posited four categories of heuristics, placing heuristics in an interactional framework of credibility assessment with the notions of 'interaction' and 'construct'.

Pan *et al*. (2007), detailed above in Section 2.3.2.2, associated the trust of participants in *Google* to meet information needs with what Gigerenzer (2004) has termed a fast and frugal heuristic within decision making theory. That the selection of *Google*'s first-returned result would have given the information seeker the most relevant result in 43 per cent of cases indicates that the use of such a heuristic is reasonably effective.

Although not situated explicitly in decision making, Flanagin and Metzger (2007) nevertheless discuss a view that links the ELM and credibility judgements. They suggest that the dual processes of heuristics-based processing and systematic processing may be occurring when, respectively, 'readily available cues such as site genre and design' and 'cues such as evaluation of message content and the results of verification efforts' (2007:338) are processed. Similarly, Robins, Holmes and Stansbury (2010:26) discuss the lack of 'a clear distinction between a visceral reaction to stimuli and a cognitive interaction with the content viewed'. Here, a visceral reaction is associated with intuitive decision making, while a cognitive interaction is associated with the analytical mode.

Making a similar link with the dual processing systems thinking prevalent in decision making literature, Cader, Campbell and Watson (2009), outlined in Section 2.3.3 above, refer to intuitive, quasi-rational and analytical cognition. Their addition of a combination of the

commonly accepted intuitive and analytical modes of cognition is of particular interest for blurring the distinctions between the two and subsequently presenting a fuller picture of naturalistic decision making.

Twait (2005) recommends the collaboration of information scientists with cognitive psychologists for the purpose of studying decision making in information seekers. To date, this appears not to have happened.

While the studies referred to in this section have taken into account selected tenets of decision making theory, none of the studies' participants were school students, leaving the field open for an investigation that considers the potential of decision making theory to feature in explanations of such a group's reliability judgements.

2.3.5 Reliability studies summed up

Both higher education and school students appear more interested in establishing relevance than determining the quality of the information before them. This is apparently related to their emphasis on information utility. School students rarely take into consideration the reliability of information, and tertiary students accord accuracy a low ranking, although they sometimes consider an author's affiliation, currency of the information, support given by references and bibliographies, design factors, and methodology. In non-education settings, influences on reliability judgements include design and structure of the information. The current investigation will consider the extent to which reliability judgements play a part in school students' information evaluation and what, if any, criteria are used in these judgements. For example, do the credentials of the author, or the design of the information, feature in such judgements?

2.4 Conclusion to literature review

This literature review has established that relevance encompasses more than the common-sense definition of it as topicality, that is, the extent to which an information source matches what the information seeker needs. Variables that form part of relevance judgements include the context, or situation, the nature of the information problem, and the task being undertaken by the seeker of the information; in addition, cognitive and affective dimensions enter relevance judgements. Thus, assessments of the relevance of a piece of information may include factors such as its specificity, its depth or scope, its clarity and how understandable it is, its novelty, its genre type, and its accessibility. Relevance judgements have been observed to vary according to ISP stage.

In this review of the literature, the focus has been on user-defined relevance; that is, relevance has been considered from the point of view of the user, rather than the information system. Inevitably, there are interactions between users' relevance judgements and the relevance rankings of an information system, such as a search engine. It may be argued that, because the information system's relevance rankings precede those of the user, they take precedence and limit the pool of information upon which the user is able to make his or her judgements. This notion is reinforced by studies in which participants have depended on the relevance rankings of *Google*.

There are examples in the last decade or so of authors who conceptualise relevance as primarily a characteristic of an information system. They do not necessarily overlook the role of user relevance but usually only include users tangentially through the tasks they bring to IR (information retrieval), thereby downplaying the subjective nature of relevance as a human phenomenon. Hong, Thong, Wong and Tam (2001), for example, focus on the relevance of items retrieved by a digital library system. In their analysis of 585 interviews with students of the Open University Hong Kong about their use of E-library, they define relevance as 'the degree to which the system matches tasks as carried out in the current environment and as specified in the task analysis' (2001:105). Hong *et al*. do, however, acknowledge the growing body of research into information retrieval systems that takes into account relevance judgements made by users. Vakkari and Sormunen (2004), in an approach typical of an experimental setting, had a panel of judges assess the relevance of a collection of documents, and then asked participants to rate the relevance of the documents to given problems.

Assessments of judges and participants showed low correspondence; the authors suggested that this was a result of the searchers' unfamiliarity with the Okapi system and their difficulties with selection of search terms. Users' knowledge of a particular information retrieval system's design and operation, and their search skills, are important variables that would confound attempts to evaluate an information system. Even so, Vakkari and Sormunen's approach emphasises the relevance to a user of documents that appear to have been regarded as having an almost intrinsic relevance, a relevance whose level is capable of prejudgement. This contrasts with a user approaching the document to check its subjective relevance, notwithstanding Vakkari and Sormunen's implied point that the set of potentially relevant documents judged as relevant has been diminished as a result of unfamiliarity with the system and limited skills in searching.

Some studies have subsumed, in the concept of relevance, such factors as quality, authority and reliability. The current study treats these factors separately and groups them as reliability, including in that construct factors such as trustworthiness and credibility. My separate treatment of relevance and reliability has been motivated by pedagogical considerations; specifically, that reliability should be singled out for teaching separately; and by a belief that most reliability judgements occur once relevance has been established by the information seeker. Furthermore, dealing with relevance and reliability as discrete, yet connected, constructs is motivated by a widely held view that students often do not critically evaluate the information that they use in tasks set by their teachers, pointing to the need for a better understanding of students' perceptions of reliability.

Most relevance studies of students have been of university students, rather than school students; while the same situation applies to reliability studies, there are signs that this is an emerging area of interest, perhaps because of a concern over the impact of easy access to online sources not subject to traditional quality control methods; the apparently limited evaluation by students of information; and the possible impact on educational outcomes of the foregoing. Many studies, using a variety of participants of varying ages, have revealed the importance of visceral reactions to website design in reliability judgements. Participants also often depend on their knowledge of genre types, or media types to assess information; for example, they may view print sources as more reliable than online sources.

Criteria used in credibility judgements may be grouped into three sets (Kim 2010:online; see Table 2.13). Kim's (2010) three sets correspond, respectively, to those of Flanagin and Metzger (2007): message, sponsor and site credibility. Complementing these typologies are the four groups of heuristics used in credibility judgements outlined by Hilligoss and Rieh (2008): those related to media, source, endorsement, and aesthetics.

Set	***Examples***
Criteria related to information itself	Quality, accuracy, clarity, currency, spelling and grammar, tone of writing, bias, usefulness
Criteria related to source or sponsor of website	Author's contact information, authority, expertise, affiliation, reputation, presence of the organization's address, type of source
Criteria related to website as a whole	Design and look, reference by reputable sources, navigability, functionality, advertising, customer service, and website host

Table 2.13: Groups of criteria used in credibility judgements (Kim 2010)

Studies of relevance and of reliability, respectively, have been linked with decision making theory, often linking users' criteria with the notion of satisficing. Some research, however, has been linked to the dual systems of processing: intuitive and rational. Decision making theory is broadly applicable to any study in which participants are making decisions about what information to use, whether they have judged it relevant or reliable, or both.

CHAPTER 3: METHODOLOGY

3.1 Introduction

3.1.1 Research questions

The foregoing literature review has revealed that there are few studies of school students that focus on their judgements of the relevance and reliability of information. While several studies of these aspects of information seeking behaviour have been made of university students, the field is open for research into school students' interactions with these aspects. Few studies have been situated in decision making theory and thus there is scope for such a contextualization (see also Section 6.1).

Wilson (2003:446) maintains that the phenomenon of interest in information behaviour research is 'the interaction of the information seeker with the potential sources of useful information'. Having regard for Wilson's point, my study focuses on two aspects of the information seeker's interaction with sources of information that they consider may be useful to them in the completion of their tasks, namely the relevance judgements and reliability judgements made by secondary school students.

Three research questions that flow from such a focus are the following:

1. What relevance criteria are employed by secondary school students when searching for information to use in information search tasks?

2. What reliability criteria do such students employ when completing tasks of this nature?

3. What is the context in which the foregoing relevance and reliability criteria are applied, that is, what is the processual context in which decisions about relevance and reliability are embedded?

The foregoing research questions place more emphasis on information use than on information seeking and information searching. In attributing a focus on seeking and

searching to information technology's highlighting of information systems and services, Wilson (2003:449) advocates that we 'consider how those activities lead to 'meaningfulness of actions'.

3.1.2 Other introductory comments

Many studies of Web credibility have been concerned with people's evaluative judgements, which Taraborelli (2008:196) defines as those made 'in order to estimate the trustworthiness of a source of information on the basis of extensive inspection of the content and credentials provided by the source'. Taraborelli, however, considers predictive judgements, those made *about* the source, rather than a detailed consideration *of* the full source itself, to be of more importance than evaluative judgements. The logical consistency of such a position is clear: unless the available information *about* the source is sufficiently appealing to the seeker, the full source will never be accessed; for an information source to be considered relevant, the searcher must have deemed it to have some meaning for him or her (Budd 2004), and its meaningfulness becomes evident even before the full source is accessed. My study fortuitously addresses Taraborelli's (2008) identification of an under-representation of predictive judgements in existing investigations.

When Bråten, Strømsø and Salmerón (2011) studied 128 Norwegian undergraduate students' evaluations of the trustworthiness of seven texts, participants were directed to judge the trustworthiness of the information. In discussing their results, the authors consider the possibility that such an instruction may have predisposed the students to focus on trustworthiness criteria, which they would not otherwise have done. As a solution, Bråten *et al.* recommend the use of think-aloud data to capture the spontaneous evaluations of students. My study adopts such an approach.

When Fitzgerald and Galloway (2001) discovered evaluative strategies among their participants not identified in previous studies, they recommended that similar studies be undertaken until redundancy becomes evident. A researcher aiming for such redundancy, however, should bear in mind Tang and Solomon's (2001) comment about the unrewarding nature of such an endeavour, based on the multiplicity of information contexts and the diversity of information needs.

Coiro and Dobler (2007:214) refer to the 'lack of a research-based understanding of the

strategies needed to successfully read and understand information on the Internet'. They recognise that the academic success of students is likely to depend on their 'skills and strategies to comprehend and respond to information on the Internet'. It is thus worthwhile studying the skills and strategies of those students whose academic achievement is high, in order to shed light on which approaches are effective. The pedagogical implications of the findings of this study will therefore be discussed (see Section 5.8).

If Wilson (2010:32) is right that 'the present focus upon small-scale studies focusing upon the information behavior of readily accessible groups of people will decline as investigators discover that there is little new that can be said', then my study is part of a fading genre. I do, however, take heart from his earlier point that the use, in education, of the Internet by school students will continue to feature on research agenda.

Given the abundant supply of information currently available, much of it online, it is of educational importance that we understand the strategies adopted by students, who regularly are faced with information search tasks during their studies, and whose performance on these tasks influences their academic progress. The present study focuses on mid- and upper-secondary students, and its findings will thus be of interest to tertiary educators, who will gain from it an awareness of the level of preparedness for their courses of study of students entering post-secondary institutions; in particular, my study offers a glimpse of the level of information evaluation skills possessed by a group of secondary school students. Of possible interest in future studies may be the question of whether sophisticated information evaluation skills are associated with higher academic performance.

The current chapter outlines the approach I took to gathering and interpreting data related to my research questions, namely the sets of relevance criteria and reliability criteria employed by middle and upper secondary students, and the context of the processes within which they applied those criteria. In an attempt to understand the experience of an information search task from the perspective of the participating students, the study collected data from students' journals; structured and semi-structured interviews; think-aloud reports; video screen captures; video-stimulated recall interviews; and questionnaires. My investigation was designed as a study influenced by grounded theory (see Section 3.2 below) and data were thematically analysed. Such an approach was considered appropriate for the investigation of

> information seeking and usage (with its focus on relevance and reliability criteria), in which little theory has been developedin relation to the target group, secondary school students. Although not able to isolate myself completely from the literature, I maintained an awareness of its influence. Motivated by an interest in developing original thinking in the area, I put aside findings of other studies, particularly other grounded theory studies, when analysing the data I had gathered. Grounded theory building is predominantly an inductive approach, that is, it is derived from data (Alvesson & Sköldberg 2009).

Participants were secondary students at an independent school in south-eastern Australia. (Further details about the school context may be found in Section 3.6 below.) The thirty-seven students taking part ranged in age from 14 to 17 years old. Like the study of first-year university students by Hargittai, Fullerton, Menchen-Trevino, and Thomas (2010), my study included a strong emphasis on the use of the Internet with no prescription of which sites to visit. It captured spontaneous information behaviour directed entirely by each student. The naturalistic setting may be contrasted with a study set in a laboratory, or one in which participants are required to use particular online resources. The students in the current study were engaged in research tasks in a range of curriculum areas, including the Humanities (particularly History and Contemporary Issues), English, Science, Legal Studies and Music. One student undertook an information search in a co-curricular area, that is, one complementing, but not part of, the regular curriculum. Students were given considerable choice in which topics they pursued within the broader curriculum topic areas. My intention in gathering data across subject areas was to develop a generic framework, applicable across the curriculum, of students' approaches to the judging of relevance and reliability of information. Hargittai *et al.* (2010) claim a unique methodology in that it permitted the consideration of trust in a broader context than, say, an examination of trust of particular pieces of information provided within an experimental setting would permit. My study, coincidentally, also employed such a methodology and thus achieves what Hargittai *et al.* consider to be a more holistic approach.

Selection of information from a set of found information is an individual, cognitive process. There is potential for unique, even idiosyncratic, approaches to be uncovered through a qualitative study that examines strategies employed by individual participants, as opposed to a survey that aims to find out how many students employ already identified strategies. Wang and Soergel (1998:118) consider the best approach to be a qualitative one, claiming that the 'best available method, used by many researchers to study the cognitive processes of human decision making, is to trace the thinking process by *think aloud* or concurrent verbalization'.

The aim of my study was to identify the processes utilised by students making decisions about the relevance and reliability of information. My investigation was of a particular group, namely secondary school students, who were identified from the literature as an understudied group. My aim was to develop a detailed understanding of student behaviour, in a natural setting, with respect to information search tasks. Several studies have investigated tertiary students but I wished to develop a richer understanding of how secondary students apply their prior knowledge, particularly prior procedural knowledge, to found information in the context of an information search task, focusing particularly on what decisions they make about the relevance and reliability of that found information. My intention was to explore the spontaneous use of strategies by students; there had been no explicit strategy used by teachers with students that was to be explored for its effectiveness, for example. I followed a use-in-context approach in that tasks were not created for experimental purposes but students made use of information while completing tasks set by teachers. While the risk of such an approach was that not all data would be as focused on the research questions as an experimental task may have been, data had the potential to yield insights into information use that may not have otherwise been revealed, had a naturalistic setting not been adopted. Students' relationships with printed books, for example, not readily evident from computer-based activity, formed part of the broader context of information behaviour.

My investigation consisted of three parts, which I have called Study 1, Study 2, and Study 3. The three parts demonstrate a progression from a broad approach to the investigation of information seeking and usage to a narrower focus on the criteria employed by students in

their judgements of the relevance and reliability of information. The parts also show a progressive refinement in the use of data collection methods to gather data about the phenomena of interest, until I independently came to the same conclusion as Wang and Soergel (1998) above about the best method. Furthermore, mixed methods are most effective in an investigation of complex phenomena.

I found that concurrent verbal reports (or, interchangeably, think-aloud reports); video screen captures; and retrospective, video-stimulated recall interviews were most successful at gaining the data of interest. I also used journals, questionnaires, structured interviews, and semi-structured interviews at earlier points in my investigation.

My paradigm, or world view, is closely aligned with social constructivism. The metatheory of constructivism is sometimes referred to as cognitive constructivism, and describes mental models as outcomes of knowledge production, with such mental models becoming more fully developed and comprehensive as the individual interacts with more information (Talja, Tuominen & Savolainen 2005). The present study is informed by cognitive constructivism, but also by the metatheory of collectivism, or social constructivism, in which the process of building knowledge is influenced by society, its history, and social interactions with others; in such an approach, social, organisational or disciplinary communities are investigated (Talja, Tuominen & Savolainen 2005). The distinction between cognitive constructivism and social constructivism is not strongly drawn in the present study; rather, the two types are treated broadly: both connote 'learning as "building knowledge structures" irrespective of the circumstances of the learning' and each may be viewed as something that 'happens especially felicitously in a context where the learner is consciously engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe' (Papert 1991:1). The two types are also considered to encompass the following (Leonardi & Barley 2008:169):

> Constructivism recognizes that each person (if persons are the unit of analysis) or organization (if organizations are the units of analysis) faces local contingencies that encourage situated improvisations, which ultimately lead to a unique constellation of practices and understandings

I wanted to improve my understanding of the world in which I work. The subjectively interpreted experiences of students became important if I was to understand information

search tasks from their perspectives. I was prepared to meet with multiplicity and variation, while concurrently being aware that I would need to distil the essence of their experiences if I wanted to communicate them. I set out, not to test a theory, but rather to generate a 'pattern of meaning' (Cresswell 2007:21) that might describe the behaviour of the group of students with whom I was working. I wished to explore students' information searching behaviour through the lens of decision making theory and, to the extent that there are no published studies that have taken this approach with secondary school students, my study should be regarded as exploratory. I use 'exploratory' as the opposite of 'declarative', noting that 'Science that explores rather than declares is a relatively recent accomplishment' (Krippendorff 2004:xvii).

I acknowledge the influence of my world-view on my choice of a qualitative approach. My temperament influences the way I see the world, through its influence on the way I process information. I therefore develop views of reality that are governed by my personal learning style, and I have noticed that studies in a narrative style are more memorable. When I recall conclusions from quantitative studies, I am more likely to recall the words than the numbers. Because constructivism makes intuitive sense to me, and its precepts generally appear to align with the way I develop knowledge about the world, I inevitably wanted to exploit that way of understanding reality. I acknowledge, however, that not everyone necessarily develops their knowledge in this way, and I expect to find diversity in the epistemology of participants, for example. Despite multiple subjectivities, there is enough commonality between people to have shared understandings, and from these, conclusions, though sometimes tentative, may be drawn about what we agree to be real. Cognitions have to be able to be shared by one person in order for another to understand them, though not necessarily agree with them. In sharing a perception of reality, others may modify their perceptions of reality, enlarging their understanding of the world. 'Knowledge is constructed in processes of social interchange' (Flick 2006:80).

In qualitative research, the researcher is considered the key instrument because he or she gathers data, rather than, say, using survey or questionnaire instruments developed in other studies (Creswell 2007), during whose administration he or she is typically more distant than, say, during an interview with a participant. The qualitative researcher must, therefore, consider his or her role in the research process. As an aid to doing this, I kept a journal of the process. The journal noted a variety of impressions about my experiences, including my reflections on data analysis and the influence of literature on my thinking. (See Appendix 5.1 for journal extracts.)

3.2 Research design

I was influenced by a grounded theory approach in the design of my research. While 'grounded theory' gives the impression of a theory, Punch (2005:155) points out that it is actually 'a method, an approach, a strategy'. Mruck and Mey (2007) prefer the term 'grounded theory methodology'. I identify elements of grounded theory in both my research strategy and method of data analysis. I set out to investigate the information search process (ISP) of secondary school students in order to gain a broad understanding of their experiences, as related by them. A grounded theory approach appeared most appropriate to explore a phenomenon about which we know relatively little, with most prior studies being of tertiary students, rather than secondary students.

The approach of grounded theory is to generate theory from data and is not primarily to test an existing hypothesis (Punch 2005). Commonly, theoretical ideas, which may contain implicit hypotheses, emerge, and the researcher sets about testing these. Punch points out that, while 'essentially an inductive technique' (2005:158), it also uses deduction. The testing of theoretical ideas entails gathering further data for analysis. Theoretical sampling is said to take place to test the emerging theoretical ideas and the cycle of data collection followed by data analysis proceeds until theoretical saturation is achieved.

Punch (2005) provides an outstanding summary of the approach to grounded theory analysis in a lucid synthesis of the five major publications on grounded theory. His overview is summarised in Table 3.1 below. Charmaz (2006:46) considers coding to be 'the pivotal link between collecting data and developing an emergent theory to explain these data'.

Action	***Performed by***	***Resulting codes***
Find conceptual categories	Open coding	Substantive codes
Find relationships between conceptual categories	Axial coding (Glaser: theoretical coding; Strauss & Corbin: coding paradigm)	Theoretical codes
Conceptualize and account for the foregoing relationships at a higher level of abstraction	Selective coding	Core code (around which the theory is built)

Table 3.1: Punch's (2005:205, 210) summary of grounded theory analysis

In a grounded theory approach, literature is regarded as having a potentially contaminating influence on the emergence of theory from the data if examined before the analysis of data. While the researcher will, ideally, have an open mind and be guided by his or her research questions, rather than be influenced by theoretical concepts from the literature, I have attempted to be conscious of the influence of the literature, while attempting to retain an openness to insights into my data. The researcher's questions are often already influenced by the literature in that they represent an investigation of selected theoretical concepts, a knowledge of which is commonly derived from the literature. Strauss and Corbin (1998:177) see as a risk a researcher's loyalty to 'the concepts and conceptual frameworks presented in previous grounded theory studies', if 'used without genuine grounding in the current study'. Note their reference to the potentially misleading effects of other *grounded theory* studies, rather than to the literature of the field in general. This may be intended as a subtlety in their view of the building of grounded theory.

I approached my data with a focus on students' relevance criteria and reliability criteria, which may be considered the conceptual categories in Table 3.1 above; I then looked for relationships between these conceptual categories. I suggest that such data analysis will commonly generate a low-level theory, with generality emerging '*from* the analytic process rather than as a prescribed goal *for* it' (Charmaz 2006:181; emphasis in original), and comparative analysis bringing 'successive levels of abstraction' (2006:178). A theory of this nature would not aspire to go much beyond describing what students do, although its descriptive categories would, necessarily, be theoretical. It would not have a high level of abstraction or generalisation; that is, it would not generate a high-level, formal theory, and would be unlikely to uncover causal factors to explain why students do what they do, although their behaviour may be explicable in terms of existing theory in, say, the field of decision making. The resultant theory may reveal antecedent conditions, rather than causal ones. Some developers of grounded theory would insist that the literature, in this case, of decision making, should be consulted only after data analysis.

Grounded theory approaches and analytic induction generally also view negative instances differently: the former offer opportunities for theoretical variation and diversity; the latter may be expected to lead to the rejection of a hypothesis (Dey 1999). If causes are conceptualised as antecedents, or precursors, of the subsequent process or stage (Dey 1999),

then this is a temporal connection. The temporal nature is clear in Glaser and Strauss's 'causal conditions', or 'antecedent conditions' as one type of condition (Dey 1999:156, 164). Suchinferences are problematic: multiple causation may be overlooked, or they 'may be based on a spurious relationship between the putative cause(s) and consequence' (Dey 1999:167).

Although Dey questions whether grounded theory is able confidently to identify causal conditions, rather than causality, he believes that observation over time may allow this to occur. After considering the difficulty of distinguishing 'complex multiple and conjunctural conditions from partially correlated but otherwise wholly unconnected events', he concludes that the 'weakness of causal inference from similarities and differences observed through constant comparison may be offset by the strength of direct observation of causal efficacy over time' (Dey 1999:172). The determination of relationships between phenomena, without attempting to determine their causality, is a more modest aim for the qualitative researcher. As Stake (1998:91-92) puts it, many qualitative researchers 'find the search for cause of little use, dramatizing, rather, the coincidence of events, seeing some events purposive, some situational, many of them interrelated'.

A grounded theory approach may be used in qualitative or quantitative research. I consider it to have had an effect on my qualitative study. I discussed above the appropriateness of a qualitative approach for my particular field of investigation; the section following attempts to explain the appropriateness of a qualitative research study and the influence of my personal preferences for knowledge building. As Charmaz (2006:178) explains, in the grounded theory approach, 'Researchers are part of what they study, not separate from it.'

3.2.1 Effect of the researcher

'Critically examining one's effect as a researcher on the research process' (Hall & Callery 2001:262-263), that is, reflexivity, is challenging, particularly for an individual researcher working alone. I feel hampered by a lack of full awareness of factors that may influence my effect on the process; however, I share those aspects of which I am aware. As Etherington (2004:36) comments: 'Reflexivity recognizes a "circulating energy between context of researcher and researched" and that both of us have agency'.

I agree with the major philosophical assumptions that underlie qualitative research. Creswell (2007) writes of five types of philosophical assumptions that prompt an investigator to adopt qualitative research methods: ontology, epistemology, axiology, rhetorical, and methodological assumptions. Considering ontology, I view reality as subjectively experienced and capable of multiple interpretations by those taking part in my investigation. With respect to epistemology, I do not think that I have become an 'insider' to the extent that some ethnologists have, but my participants and I have known each other for three to five years, although the extent to which we have worked closely with each other varies considerably; the distance between investigator and participant has been reduced through our experiences, not only as teacher and students, but also through engaging in similar academic tasks (the students in their research tasks and I in mine). The parties to the research, both students and I, as the researcher, construct knowledge; my representation of students' knowledge will be influenced by the degree of insider knowledge that I have. Watson (2004:145) supports a qualitative approach when contending that, with the focus of schools on gathering quantitative data about student performance, educators 'rarely listen to students' talk and reflections on what they know or how they learned it'. Axiologically, I will be explicit about the biases that influence my interpretations, and indicate the values on which they are based. The values of the participants will also influence the extent to which they engage in their research tasks and these will be reflected in their level of interest and motivation. Rhetorically, I employ a personal voice, and aim at an informal style, where appropriate. The results of my data analysis are presented as a narrative that merges results and findings.

I agree that 'Research aims at presenting reality not reproducing it' (Flick 2006:371). Such a stance is evocative of the mimetic process: as indicated in Figure 3.1 below, a participant's actual experience is communicated through the participant's representation of that experience; an investigator develops, from that representation, a perception of that representation, which may be termed a re-representation, that is, the investigator's representation of that representation; the investigator interprets and reports that re-representation; and the reader finally interprets that re-representation. Reality is thus mediated.

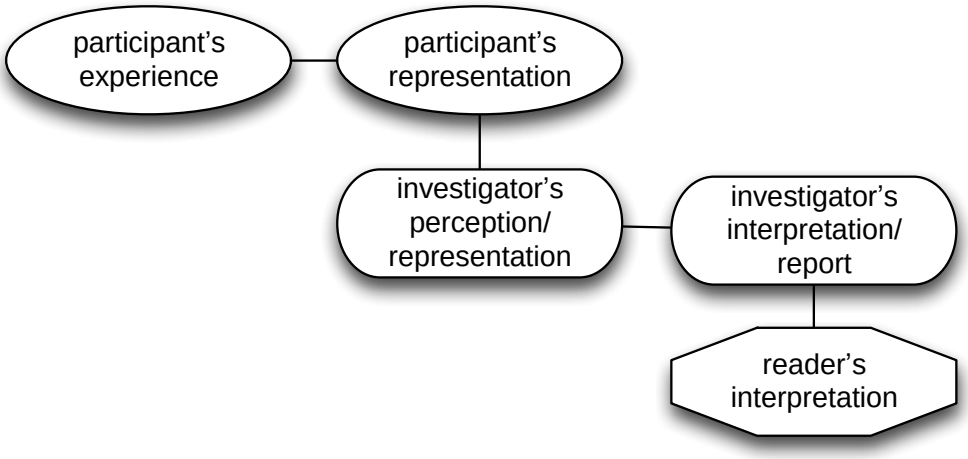


Figure 3.1: The mediated reality of the research process

3.3 Data analysis

3.3.1 Grounded theory approach to data analysis

I am grateful to Dey (1999) for a comprehensive identification of the issues surrounding the use of grounded theory. Like Glaser (Dey 1999), I use the terms 'category' and 'code' synonymously. I do not use codes, preferring to use category labels instead; these are more descriptive and their use removes the need for decoding, which seems like an unnecessary step that requires the researcher to create, apply and then 'translate' a set of codes later; modern software is able to accommodate natural language descriptions.

In approaching the task of data analysis, I preferred not to begin with a preconceived conceptual framework and therefore, for Study 1, did not begin with a set of categories or themes or codes, but attempted an inductive analysis of gathered data in which categories emerge from the data, rather than forcing the data in preordained directions. I also preferred not to use Strauss and Corbin's (1990) conditional matrix, because, although intended to be used flexibly, presupposes that data will reveal conditions, actions/interactions, and consequences. Dey refers to such coding as I used as 'heuristic coding', which is 'a characteristic of interpretive inquiry where the meanings of actors (and action) cannot be established in advance of the research' (1999:123-124). My analysis of data from Study 1 identified core categories that then formed part of a conceptual framework for Study 2 and Study 3.

When considering the creation of a new category, it is important to compare and contrast the data that will be in the proposed category with the data that are subsumed in other categories; this is done in order to gauge whether the differences in the proposed category are sufficiently distinct from the previously assigned categories to warrant the creation of a new category. Such a strategy is inapplicable when the new category is the first one assigned in a study, and so early categories are even more provisional than latterly assigned ones, with the early categories needing to be revisited (even more assiduously than those assigned later) as part of the 'constant comparison' with which grounded theory has become synonymous. Categories should identify phenomena as well as discriminate between them (Dey 1999). I believe that a grounded theory researcher cannot rely solely on *in vivo* categories that is, those used by the

participants themselves; participants may talk about concepts without giving them a clear label and potentially large segments of data could be overlooked if the coder did not develop his or her own conceptual labels. A grounded theory is verified by the data available in the immediate study and does not require follow-up studies for verification, particularly when constantly changing social realities make it almost impossible to replicate conditions. To be fully grounded in the data, all data must be categorised as comprehensively as possible and the theory that emerges should account for all the major concepts. I would feel uncomfortable about not coding all data; as I need to inspect all data, and consider whether the segment that I am examining at any one time fits a pre-existing category or warrants the creation of a new one, categorising the data while there is not an imposition. I would be concerned about missing some data that would contribute to theory development if I did not code all data gathered. 'The only rationale that requires full categorization (of every incident) is that of verification – that is, to test hypotheses', according to Dey (1999:135), who contrasts Glaser's belief in the virtues of partial categorisation with Strauss's approach of seeking further information for the verification of categories. Dey (1999:146) suggests that the decision to categorise fully or partially depends on the researcher's purposes:

> If we want to take full advantage of repetitions and patterns in the data, we may opt for full categorization, even if only to generate theory. But we may be content with a partial approach, looking only for evidence that suggests possible ways of conceptualising the data.

3.3.2 Influences on data interpretation

Much of my knowledge about the information search process (ISP), particularly my experiential knowledge, is based on informal observation of, and reflection on, interactions with students in a school environment over almost two decades, and also on the formal research I have undertaken over a three-year period. Dey (1999:104) indicates that it is impossible to remove the effect of the researcher, 'who brings to categorization an evolving set of assumptions, biases, and sensitivities', from the process of data conceptualisation. My propositional knowledge has been developed from a reading of the related literature for the purposes of formal, tertiary courses; professional development sessions and short courses; and also self-directed reading of the professional literature of teacher librarianship and education. Reason's (1998:267) discussion of critical subjectivity reassures researchers that suppression

of our 'primary subjective experience' is not necessary, but that we are obliged to articulate the perspective, and its associated bias, from which our knowledge was developed.

In order to identify possible influences on my analysis of data, I outline the main influences on my conception of students' ISP. I approached the task of data analysis with a familiarity of two models of the ISP of students and acknowledge their potential for predisposing me to view data through these models. Harry, Sturges and Klingner (2005:11) refer to the tension between analysing phenomena as if one were not influenced by personal views, even though one has prejudices about those phenomena, as the 'dichotomy between neutrality and preconception', which they suggest can be countered by 'truly reflective research habits'. Qualitative researchers should convey to their readers the basis of 'the experiential, practical, or propositional knowing that comes out of the research' in order 'to illuminate the distortions that may have occurred' (Reason 1998:268). Two models of the ISP that have influenced my thinking and been used in my teaching are those of Kuhlthau (1988) and the NSW Department of Education (?1989). The former has an empirical base, whereas the latter is essentially a description of its developers' idealised, recommended framework for students to use when undertaking an assignment that requires the finding and using of information.

Kuhlthau (1989; 2007) observed six stages in users' ISP. Affective states associated with each stage are shown in Table 3.2.

ISP stage	***User states of mind/responses***
Initiation	Awareness of his or her lack of knowledge, will generally feel uncertain and apprehensive
Selection	Short-lived optimism as the person identifies a general topic of research
Exploration	Confusion, frustration and doubts in the face of inconsistent or incompatible information
Formulation	Becomes more confident as a result of the formation of a cognitive focus
Collection	A sense of direction and an increase in confidence are evident as the person collects information related to the focus he or she has developed
Presentation	Feels satisfied or disappointed, is able to explain to others what he or she has learned, or demonstrates a use for his or her learning

Table 3.2: Affective states in Kuhlthau's (1989; 2007) six-stage ISP

The NSW Department of Education's (?1989) information process model is also a six-stage process:

Stage	***Students' behaviour***
Defining	Defining their research topic in order to make clear what their research need is
Locating	Looking for information
Selecting	Deciding what information they will select from their found information
Organising	Deciding how they will organise their information
Presenting	Considering how best to present their information to suit the needs of their audience
Assessing	Evaluating both their ISP and the product of that process

Table 3.3: NSW Department of Education's (?1989) information process model

I have given Kuhlthau's work more credence, because of its empirical basis, than the NSW Department of Education's (?1989) model. Her respected research work has given me greater confidence when presenting arguments to teaching colleagues for the adoption of teaching and learning approaches that flow from it. I also favour it for the educational philosophy underpinning it, namely constructivism, 'the view of learning as an active, effortful process on the part of the learner to build his or her knowledge' (Muller, Sharma & Reimann 2008:281). I have, however, also used the New South Wales model successfully with students from a non-English-speaking background.

The concepts of the ISP models referred to above are possibly so entrenched in my thinking that they interfere with my interpretation of the data that I gather. One must put aside what one is most familiar with in order to find a new theoretical structure for data in a study influenced by grounded theory. It would, however, surely be a rare theory if it had no connection to any existing theory. To extend the metaphor, it would be rare to find a language that had no resemblance to any other language. My way of dealing with this is to map the similarities and differences between my theory and those with which I am familiar (see Table 5.2).

3.4 Data collection methods: adequacy to capture phenomena of interest

In this section, I briefly consider the physical setting in which data were collected, before turning to particular data collection methods, beginning with the two that I regard as having provided the most fruitful data to answer my research questions: concurrent verbal reports and video-stimulated recall interviews. I base my choice of concurrent verbal reports, or think-aloud protocols, primarily on the arguments of Ericsson (2002), and Ericsson and Simon (1993; 1998); I was persuaded of the validity of video-stimulated recall interviews by the work of Omodei, McLennan and Wearing (2005), and Omodei, Wearing and McLennan (1998). I continue with a discussion of my use of semi-structured and structured interviews, concluding the section with a reflection on why traditional observation was inappropriate for my purposes, and focusing finally on a selection of other data collection issues.

3.4.1 Experimental setting

The place selected for the interview was a reasonably quiet room that formed part of a school library. The room had sliding glass doors through which interviewee and interviewer were able to see students going about their work in an adjoining room. It was possible to ensure that almost no interruptions occurred. While an interview was an obvious investigative device, the screen capture of searching activity was less obtrusive, in that the student was left alone to behave in as natural a way as possible.

The room used for interviews was also used for students to engage in information research in their chosen topic area. As my research activities were conducted at the school attended by the participants, both the library and the room where they met with me were familiar to them. Students were most likely comfortable in their physical environment. Their established rapport with me is also likely to have contributed to a relaxed, non-threatening approach to their investigated experiences.

3.4.2 Concurrent verbal reports

My choice of concurrent verbal reports was greatly influenced by the arguments of Ericsson and Simon (1993). Considering Ericsson and Simon's theory that 'a subset of the sequence of thoughts occurring during performance of a task is stored in long-term memory' (1993:*xvi*), I used concurrent verbal reports, to capture as large a set as possible of these thoughts (knowing that it would not be possible to capture all thoughts, as participants are likely to have many more thoughts than can be communicated in real time), and also interviews, which required recollection of the thought processes experienced immediately prior. This follows Ericsson and Simon's recommendation that 'whenever appropriate, both concurrent and retrospective reports be collected' (1993:*xvi*). There was no delay between these two stages, except for one participant, for whom there was a 24-hour delay.

Ericsson and Simon claim that participants' thinking processes are not affected by the instruction to think aloud, when they 'verbalize directly only the thoughts entering their attention as part of performing the task' (1993:*xiii*). They refer to think-aloud reports and retrospective verbal reports as Type 1 and Type 2 verbalisations, respectively. They distinguish these from the situation of participants being instructed to describe or explain their thoughts; such a situation will affect the sequence of thoughts 'because the subjects must attend to information not normally needed to perform the task' (1993:*xiii*). Such verbalisations they name Type 3. Apparently the sort of task to which Ericsson and Simon (1993) are referring is a task that has one right answer, as in a mathematical calculation, for example. It is unclear whether their claim would apply to tasks that are open-ended, such as in a task requiring the presentation of an argument in essay form. The latter task may require more rationalisation, justification and explanation, even to the individual himself or herself, on a sub-vocal or metacognitive level, than the former, closed-ended task.

Ericsson and Simon differentiate between verbalising during 'solving problems, performing actions, and making evaluations and decisions' (1993:*xiv*), on one hand, and verbalisation that may occur for the purposes of social communication, on the other. In the latter type, the speaker is concerned to be articulate and lucid, and to take into account the background knowledge of the listener. I indicated to participants that I did not expect that they would have logical, ordered thoughts, and that they should do their best to say what thoughts were passing

through their minds without thinking about their thoughts. Verbalisations are characterised by 'incomplete sentences and phrases' and participants 'rarely correct their verbalizations including speech errors' (Ericsson and Simon 1998:181). My absence from the room during the concurrent think-aloud report indicated that the report was not a social conversation but one that required a focus on the participant's thoughts, without regard for the need for a coherent account or a sensitivity to the listener's likely state of knowledge about the matters being reported on. When attempting to elicit the verbalisation of thinking with the least amount of reactivity, a crucial precondition is 'that the participants are allowed to maintain undisrupted focus on the completion of the presented tasks' (Ericsson & Simon 1998:181). In the concurrent think-aloud report, the participant was not asked to focus on any aspect of his or her performance but to verbalise as much of his or her thinking as possible. In the interview that followed immediately, my questions gave the participant specific aspects of his or her thinking processes to consider.

Based on the work of Nisbett and Wilson, Ericsson and Simon (1993) claim that if the retrospective interview probes thinking that did not occur during the experience, then participants are likely to 'theorise' about what they would have thought, or to draw on similar situations, offering what they thought in situations that parallel the one under consideration in the interview. Citing Ross's research, Ericsson and Simon suggest that participants 'spontaneously retrieve previously encountered problems with their stored solutions when confronted with new problems having similar surface features' (1993:*xlvi*). 'The major determinants of what is recalled appear to be when and how subjects are asked to report their relevant knowledge' (Ericsson & Simon 1993:*xlvi*). While they believe that asking a subject for descriptions and explanations will result in Type 3 verbalisations, which demonstrate interference in thinking processes, I do not claim unequivocally that students did not interpret the instruction to think aloud as one requiring description and explanation. Inevitably, for part of their thinking aloud, at least, they gave descriptions and explanations.

Ericsson and Simon (1993) are under no illusions that verbalisation of Type 1 and Type 2 will give a complete picture of a participant's cognitive processes. A participant is not able to verbalise all his or her thoughts; a verbal report is also limited by the apparent inability of participants to detail 'the perceptual and retrieval processes that determine which thoughts or patterns will reach their attention' (Ericsson & Simon 1993:*l*). This suggests that participants

have not heeded, or perhaps are unaware of, the reason for paying attention to a particular thought. This is not a concern in my study, as I was more interested in the thoughts of participants than in why they attended to those thoughts.

Concurrent and retrospective reports fall into the category of introspective reports. Introspection has been defined by William James (cited in Ericsson & Simon 1993:50) as the act of 'looking into our own minds and reporting what we there discover'. Ericsson and Simon (1993:16) assert that concurrent verbal reports and retrospective reports are two types of verbal report that may be considered 'the closest reflection of the cognitive processes'. Their argument is based on a model in which information to which the participant is paying attention is held in the short-term memory; the participant accesses information from short-term memory for such processing as the production of a verbal report. If information were drawn from the long-term memory, it would need to be moved to the short-term memory in order to make it available for producing a verbal report. Ericsson and Simon's key hypothesis is that the short-term memory's limited capacity means that 'the most recently heeded information is accessible directly' (1993:11).

The best time for a participant to give a report, according to Ericsson and Simon (1993), is directly following the completion of a task; this is when the short-term memory is still holding the bulk of the information. I extrapolate from this that a concurrent verbal report would be as effective at tapping cognitive processes. Ericsson and Simon confidently maintain that a retrospective report elicited immediately following a cognitive activity, and produced in response to a general instruction to the participant to recall everything about his or her thoughts, will 'give us the closest approximation to the actual memory structures' (1993:19). Despite the ideal nature of such a report, they acknowledge two general problems with it: retrieval may be imperfect ('other similar memory structures may be accessed instead of those created by the just-finished cognitive process'); and there may be some interference from 'information acquired previously or subsequently that is associated' with information that was attended to during the cognitive activity that has just been completed. I consider that my use of concurrent verbal reporting addresses the second problem as fully as possible (the information noted during the segment of activity under investigation may, for example, evoke some information from long-term memory and 'interfere' with the contents of short-term memory); and that it goes a long way to reducing the impact of the first of the authors' problems.

One of three major criticisms of the use of concurrent reports is that when participants know that they will be verbalising their thoughts during a cognitive experience, or even subsequent to it, their performance and therefore their associated cognitive processes are different from what they would have been without the investigation's influence. This criticism is referred to as the verbalisation argument (Ericsson & Simon 1993), that is, that verbalisation of thoughts influences performance. I attempted to address this by not asking participants to focus on any particular thoughts that crossed their minds; the instruction to participants was, in its distilled form, to think aloud while completing the search task. I did not want them to narrow their focus of attention to matters related to relevance and reliability of information, as I wanted these matters to emerge in a spontaneous way, that is, without the participants feeling obliged to frame their thinking in these terms, which may have led to a loss of some contextual detail, for example. In Ericsson and Simon's words, 'Requesting a certain kind of information may suggest to subjects what aspects of the task are important' (1993:22). Ericsson and Simon hypothesise that participants who are asked to explain their thinking may take longer than those who are not required to verbalise their thinking, but that the recoding required for this does not alter 'the structure of the process for performing the main task' (1993:79). Their review of around thirty empirical studies concluded that task characteristics and instructions given to participants are the key predictors of the influences of verbalisation on thought processes.

After Ericsson and Simon (1993), several additional studies have added support to their conclusion (Ericsson & Simon 1998). Ericsson and Simon uncovered only a 'few studies where subjects are simply instructed to verbalize the heeded information', noting that, in most studies using think-aloud instructions, those instructions included restrictions 'with respect to the timing, frequency, and content of their verbalizations' (1993:77). They assert that such studies' use of think-aloud methods does not interfere with the cognitive processes of the participants, while they claim that cognitive processes change when participants attempt to fulfil the conditions imposed by the investigator. The challenge is to find a method that elicits the expression of cognitive processes as they occur, without the potentially confounding effect of those processes being transformed before being articulated. This seems a futile search unless we develop some method that bypasses the expression in words of those cognitive processes. Even then, physiological methods, such as those used in studies of brain activity, suffer from being based on aggregates of subjectively experienced states.

A second criticism of think-aloud and think-after protocols is that they are not able to capture all the participant's thoughts. Referred to as the incompleteness argument (Ericsson & Simon 1993), the suggestion is that the participant may not verbalise all the thoughts that he or she has. It seems to me that we are always investigating slices of experience, or samples of a participant's broader experience, rather than aspiring to capture every aspect of that experience in an exhaustive manner. Ericsson and Simon (1993:64) acknowledge this when they express doubt about Watson's claim, which they cite, that thought is internalised speech, asserting instead that 'internal activation may occur without peripheral activation', which has the corollary that 'the overtly verbalized information is a subset of the internally activated oral information'. Ericsson and Simon suggest that information to which attention is given is indexed in long-term memory to aid in the retrieval process, and that experts appear to access information in long-term memory almost effortlessly. The investigator who uses think-aloud methods is then accessing heeded attention in short-term memory, whether the verbalisation is concurrent with the stimulus or whether the stimulus that activated the memory has past, and the only traces of the experiences that remain are in indexed information in the long-term memory and then brought into short-term memory when verbalised.

In parallel with a constructivist view of learning, the information-processing model presented by Ericsson and Simon allows for the formation of new memory structures through 'bringing together the contents of focal attention with information accessed from LTM [long-term memory]' (1993:117). Similarly, a connection of information occurs in short-term memory, in which it is hypothesised that there is 'a sequence of states, each marked by a small collection of information' (1993:118); each element of the sequence 'is the *output* of the process that operated on its predecessor and the *input* to the process that will produce its successor' (1993:118-119; italics in original). Ericsson and Simon claim that 'the process that creates these input-output relations … is opaque and its intermediate states are not reportable' (1993:119). While it may be possible in my study to trace what pieces of information individual participants relate to each other, and to hypothesise what the catalyst for creating the connections is, Ericsson and Simon's point is that an awareness of the input-output relations is not the same as 'direct information about the process itself' (1993:119). The authors add that they are not implying that responses are beyond participants' cognitive control, pointing out that information may be evaluated and processed before being used in a response. Ericsson and Simon's major point in response to allegations of incompleteness in

verbal reports is intertwined with the relationship between heeded information and reportable information: 'the information that is heeded during performance of a task … is the information that is reportable; and the information that is reported is information that is heeded' (1993:167). What may appear to be incompleteness is, in fact, the inability of a participant to recall something that he or she never heeded in the first place. From the student's perspective, the information reported could quite possibly be complete and adequately explain his or her view of the world.

The third major criticism of the method is known as the epiphenomenality, or irrelevance, argument (Ericsson & Simon 1993). Here, the claim is that some other cognitive activity may be taking place simultaneously with, but independently of, that related to the target task. Ericsson and Simon marshal considerable evidence that 'verbal data … are highly pertinent to and informative about subjects' cognitive processes and memory structures' (1993:220). It seems inconceivable to them that participants would 'produce a stream of words, parallel but irrelevant to the cognitive task they are performing' (1993:220). In my study, the use of video screen capture provides a means of establishing the degree of correspondence between verbal report and activity on the screen, thereby also giving the opportunity to gauge relevance of words to screen activity.

'Thinking aloud has now gained acceptance as a central and indispensable method for studying thinking' (Ericsson & Simon 1998:182). Ericsson (2002), however, indicates that, without standardised procedures and complete documentation of investigators' instructions, a thorough task analysis is not possible. Without such task analyses, it becomes difficult to establish the influence of the verbalisations on the cognitive process, and to determine the level of reactivity on those processes; in turn, ascertaining the validity of claims of reactivity-free, think-aloud reports becomes problematic. The use of think-aloud reports to elicit cognitive processes is based on the assumption that the investigator's instructions strongly influence thought processes, which are then reflected in the participant's verbalisations.

3.4.3 Video-stimulated recall interviews

In Studies 1 and 2, I was concerned about a potential limitation in the interview method, namely that I was relying on the recollections of participants, which could not be verified, or at least for which it was not easy for the participant to provide evidence. Therefore, inspired by the sound argumentation of Omodei, Wearing & McLennan (1998), I used a form of the video-stimulated recall interview method in Study 3.

Omodei *et al.* (1998) consider that situations of naturalistic decision making often display features that pose challenges to collecting data and that such challenges therefore hinder theory development. The difficulties that they identify include: the creation and manipulation of a decision making situation; an inability to interrupt the task; and the problem of insufficient recall by participants of details. Omodei *et al.* (1998) identify three strategies designed to improve data quality in naturalistic decision making situations: debriefing of participants promptly after decision tasks; eliciting both typical and atypical incidents; and prompting recall through the use of a video recording of the decision task. They point to the successful use of video-stimulated recall techniques, but note the following drawbacks to its typical use: the intrusive nature of a camera and the operators of recording equipment; the rapid movement of decision makers, especially if they are fire fighters, such as Omodei *et al.* studied; the blocking of the camera's view when people move; and the limited perspective of the camera. The researchers solved the problem by employing a small camera mounted on the heads of participants; this simulates the human visual system. Omodei *et al.* (1998:140) claim that such own-point-of-view recording increases both external and internal validity; the former because 'only visual information which is potentially available to the subject is recorded' and the latter as a result of the 'close match between the initial and the replayed perspective', which enhances the ability of the participant to recall the original situation, with the 'pause' facility permitting detailed descriptions of experiences that may have been transitory or not verbalised originally. Furthermore, a key characteristic of an own-point-of-view recording is that the participant does not see him- or herself in the recording, thus minimising the 'self protective attributions and selective reporting of those experiences the participants feel are appropriate or expected by the enquirer' (Omodei *et al.* 1998:144).

Omodei *et al.* advocate a two-stage debriefing procedure that entails the playing of the recording in full twice: the purpose of the first playing is to 'relive and recall all mental events which occurred during the original task, uncensored for relevance or appropriateness' (1998:141); in the second playing, the interviewer uses questions related to the 'fundamental psychological processes which generated the relatively high-level symbolic representations recalled in the first, discovery-oriented, recall session' (1998:141).

I chose not to use the two-stage debriefing procedure because, when the recall was needed, participants had just completed their search session with its think-aloud report, and so their experiences were still fresh in their minds; and I was concerned that fatigue, related to monotony, may ensue in what was likely to be a cognitively demanding one-on-one interaction with the researcher if the student first had the experience and then, immediately following it, viewed the recording twice.

I deliberately did not use audio recording when replaying the video sequence (though this was suggested by Omodei *et al.* 1998), as I was concerned that the original verbalisation would frame the subsequent verbalisation too strongly and reduce the likelihood of additional detail being recalled that, although part of the original experience, was not verbalised, perhaps because of time constraints. The participant could not verbalise all thoughts without interrupting the flow of the task, and a replaying of the audio recording may have led to a focus on only that which was expressed.

Omodei *et al.* (1998) discuss four aspects of the cognitive theory at the base of own-point-of-view cued recall utilising video-recordings: psychological re-immersion; presumed memory mechanisms; retrieval of pre-verbal experiences; and increased psychological sensitivity of an own- versus other-point-of-view perspective. When the participant views the recording, he or she is stimulated to recall the details of the original situation and shows an ability to recreate the experience in its psychological fullness. The participant narrows his or her focus on the experience being replayed on the screen and is not readily affected by the present environment as a result of being 'psychologically *re-immersed* in the original situation' (Omodei *et al.* 1998:142; italics in original).

In an attempt to cue the recall of the original experience, the researcher aims to activate the expectations and goals that were operative in that original experience. Encoded in our memories are those experiences to which we have given our attention; Omodei *et al.* (1998:142) refer to 'all experience which is associated with memory encoding of any particular item of information' as context effects. Context is assumed to influence not only the manner in which information is encoded, but also the manner in which such information is later retrieved. A closely related assumption is that if the original context can be vividly evoked, retrieval will be easier. It appears that the more fully an experience can be recalled, the more likely it will have the 'feed forward' effect of improving the recall of related experiences, further enhancing the recall process. The replaying of video material offers information about memory structures, which Omodei *et al.* (1998:143) assert are 'personal, and organised by time, place of occurrence, and perceptual characteristics'.

The use of a video recording of the original situation has the potential to stimulate the recall of experiences that were not verbalised at the time, and thus give the participant the opportunity to verbalise these pre-verbal experiences when the video material is replayed. Being able to pause the video material may also give the participant an occasion to express more coherently something that was not expressed well at the time. Omodei *et al.* contrast the use of questions by the interviewer with the use of video material as a means of stimulating recall, and suggest the latter's mainly visual cues, as opposed to verbal ones, with their lack of 'inherent demand for coherence and logical progression' (1998:143), make it superior. Equally, they suggest that non-verbal dimensions of the original experience are more readily recalled when participants view the visual record. The researcher is more readily able to gather data related to the 'holistic-intuitive' cognitive processing associated with naturalistic contexts (Omodei *et al.* 1998:144).

Like the wearing of a head-mounted camera, the recording of screen activity in my study captures data in the viewer's field; without a camera in sight, the participant is more likely to lose the sense of awareness that activity is being recorded, which may otherwise interfere with the spontaneity of behaviour. The perspective of the participant is the same in the original experience as in the recording, thus maintaining a consistency in the literal point of view.

Omodei *et al.* (2005:275) note three advantages to using the own-point-of-view perspective. One benefit is that the perceptual field is so faithfully reproduced in the replay that it acts as 'a maximally-powerful stimulus to the spontaneous recollection of those mental events which occurred while the recording was being made'. The participant is able to recall experiences more fully and is less intent on presenting a positive image of himself or herself. A second advantage to the method is that the reduction in self-awareness or self-consciousness, brought about by not seeing oneself in the video replay, reduces the chances of self-protective behaviour or recollections selected by the participant to align with his or her preconceptions of what the investigator may be anticipating. The third positive feature of the method is that self-consciousness is minimized in the initial recording, which therefore increases the probability that the participant's behaviour is as close as possible to the natural, spontaneous behaviour that might be expected without the observational effect of the recording process.

3.4.4 Interviews

In Study 1, I employed semi-structured interviews in order to allow for freer responses and the opportunity to pursue any aspect of interest that arose during the interview, to thereby gain a broad picture of students' experiences of the ISP. At this stage, my research questions were less focused than they subsequently became. In Study 2, I adopted a structured interview method in order to permit a comparison between students, and included more specific reference to students' responses to information resources that they found relevant and useful; how they judged the quality of information; and how they responded to contradictory information. I used a set of eleven questions and asked them in the same order, using the same, or very similar, words to those in my question guide (see Appendix 3.9).

With individual interviews, I wanted to obtain the rich detail referred to by Gaskell (2000). Interviews are representations of the world; and the particular part of the world represented in my interviews is the experience of the student engaged in an information search task. Interviewer and interviewee are assumed to construct a reflection of reality, or what Denzin and Lincoln (2003:13) refer to as 'the socially constructed nature of reality'. I do not claim, therefore, that my interviews were a method of gathering some uncontaminated, objective or independently existing pieces of reality, but rather that they were able to yield 'negotiated, contextually based results' (Fontana & Frey 2003:62). Interviews are affected by the 'slippage, inexactness, indeterminacy' of language (Ellis & Bochner 2003:222) but

standardised surveys and questionnaires would not reflect the experiences of the particular group of students that I was investigating. There is, inevitably, incompleteness in these subjective interpretations of experiences because, ultimately, 'the whole story exceeds anyone's knowing, anyone's telling' (Stake 1998:94).

As described by Flick (2006), narrative interviews, in their pure form, in which a generative narrative question is asked, are unlikely to be successful in eliciting from secondary school students a prolonged relating of experiences. These students would find such a task too open-ended and unstructured; their strong conceptions that an interview situation entails an interviewer asking questions and an interviewee, the student participant, answering them, would also render a narrative interview approach less successful in gaining sufficient useful data for analysis. Flick (2006:178) states the drawback succinctly: 'One problem in conducting narrative interviews is the systematic violation of the role expectations of both participants'. Therefore, a semi-structured interview was used in which questions were prepared in advance but their use was flexible enough to permit the researcher to depart from them, for example, by deleting any, or changing the order in which they are asked. This permitted latitude to explore a phenomenon of interest relevant to the research questions that may have arisen during an interview.

Although not narrative interviews, principally because of their essentially question-response schema, many of the quality indicators Jovchelovitch and Bauer (2000) use for narrative interviews apply to mine. My interviews granted a privileged position to the experience of the participants by accepting their stories as real; I regarded them as 'representations/ interpretations of the world', particular to each student participating; and I did not consider that they needed to be proved true or false, but that they were manifestations of 'the truth of a point of view, of a specific location in space and time' (Jovchelovitch & Bauer 2000:72).

A key assumption of the interview method is that it gives the researcher access to the experiences of the participants. A participant's experiences, however, when retold in an interview, are mediated by the participant's interpretation of those experiences and thus the researcher does not have direct access to those experiences. All social experiences, when shared with another, are influenced by the interpretation of the sharer; furthermore, the sharer's interpreted experience is further interpreted by the receiver. The qualitative researcher finds the meaning inherent in the interpretations.

During the interview, I generally refrained from sharing personal experiences, although this was by no means a hard and fast rule. Some commentators (e.g. Cresswell 2007; Shank 2006) suggest that such sharing shifts the focus from the participant's experience; that in a phenomenological approach it is important to 'bracket' one's own experiences to allow full emergence of the participant's perspective, thereby maximising the information flow from the participant. My view is that sharing personal experiences, on occasion, assisted in the building of rapport and sometimes reassured the student that what they were experiencing was a normal part of the information search process; an example was the sharing of frustration at having to cut back the material written in order to meet a word limit. Although Fontana and Frey make the following point specifically in relation to gendered interviews, I felt that it applied to my interviews: 'Interviewers can show their human side and answer questions and express feelings' (2003:83). I was not usually asked questions, however, unless I invited them near the end of the interview, and I expressed my feelings sparingly, possibly more out of a concern for the efficient use of the participant's and my time than as a result of deliberately trying to suppress their expression.

3.4.5 Reflective journals and questionnaires

Reflective journals and questionnaires were used in Study 1. The journals were intended to offer participants a way of providing unstructured data about any phenomena that they considered worth noting. Data from the journals complemented the interview data gathered in Study 1 and did not offer anything of importance that interviews did not. Moon (2006:18) refers to the 'secondarily processed version' of learning that is evidenced in journals, and notes that they are useful for making sense of a situation, especially when it is an ill-structured one; for providing a means of expressing emotion; for developing metacognitive awareness; and reflecting on the processes associated with experiences.

A very limited form of questionnaire was used at two points in the ISP of the participants: when students had selected a topic for research, and when they were about half-way through the ISP. Two broad questions were asked on each occasion: one about what students were finding challenging, and one about areas in which they felt they were experiencing success. Responses were often brief, incomplete, and lacking in the context of the respondent's success or challenge.

Neither the reflective journal nor the questionnaire was used to collect data after Study 1. The level of redundancy between journal and interview was high; and the lack of detailed response in the questionnaire did not offer rich enough detail for analysis.

3.4.6 Rejection of traditional observation method

I do not regard the observation of search behaviour within a class grouping of students as a satisfactory method. When I attempted to observe in such a setting, I found that I had to spend considerable time with an individual to note what search strategies were being employed, and the process of selecting what was relevant and reliable could not be discerned except by asking the student, in which case the encounter became a mini-interview. Such an interview was unsatisfactory in its lack of detail and the extent to which the questioning interrupted the student's thought processes and therefore influenced them, that is, the student's decision making processes were not given the opportunity to evolve spontaneously.

Observation may be a satisfactory data collection method when more than one subject is involved, and where the targeted behaviour is very evident from the observation. In the case of my research, I was able to observe which information source a student had selected but, without a brief enquiry, would not have been able to discern why that resource had been chosen; that is, the decision process was cognitive, and could not be inferred from the behaviour with any degree of confidence. Mental activity is not evident, in any significant depth, from outwardly observable behaviour; and in my investigation, would have run the considerable risk of being unreliably inferred from the observable behaviour. While it may be possible to observe decision outcomes, traditional observation methods will not uncover the psychological processes that led to those outcomes.

While video screen capture may be an observation method, in that I observed the task-related actions of students, I argue that my prime use of these data was to stimulate students' recall of the actions that they had taken shortly before the interview based on the recorded activity. I distinguish video screen capture from the traditional observation method of standing outside the action of the participant to observe behaviour according to preconceived categorisations of behaviour. Video screen capture allowed an individual student to generate data that I could watch with the student as soon as practically possible after the event; and that would provide confirming evidence of any claims made by students in other interviews, that is, those not using the stimulated recall method.

3.4.7 Other data collection issues

Commentators such as Bauer, Gaskell and Allum (2000) express concern that participants will have conceptions about what the interviewer would like to hear and that these conceptions will influence what the interviewees say. I feel that occasions when students did not simply 'go along' in agreement with my suggested interpretation indicate that they were not telling me what they thought I wanted to hear. My interpretations, and attempts at clarification, would have been strong clues to what I thought, or perhaps would have liked to hear, and it would have been easier for students to go along with my interpretation. On occasion, student participants corrected or modified a view that I expressed, thus indicating the social construction, or negotiation, of meaning. This suggests that at least some participants felt comfortable enough to address any misunderstandings they perceived I might have had about their experiences, indicating that the teacher-student/interviewer-interviewee relationship was such that I could be corrected.

When Cohen, Manion and Morrison (2000:279) refer to children who 'will tend to say anything rather than nothing at all, thereby limiting the possible reliability of the data', it is not clear how old the 'children' are. In my study, participants' contributions were relevant to the questions I asked and there was a consistency in their answers. The claim, however, that children will say anything may apply when students are asked, for example, to justify a choice of a source but, because they have made the choice intuitively, they are not able to express their reasons for the choice in words. Two participants in Study 2 indicated that they were not able to articulate their reasons for some of their actions; others possibly came up with *post facto* explanations without admitting this, or even being aware that this was happening.

An argument against this stance is that there was considerable consistency among participants in the justifications given. Conceivably, participants had all been socialised through a similar education process to approach information seeking and usage in a similar way, reflecting the theoretical approach that they had been taught, even if they did not necessarily practise it.

The equipment used was as unobtrusive as possible to maintain the naturalistic aspects of students' tasks. I wanted to examine what Stake (1998:92) calls 'ordinary practice in natural habitats'. Study 1 employed an external microphone but, in an attempt to reduce unfamiliar paraphernalia, Study 2 used the built-in microphone of a laptop computer.

In Study 3 a small, hand-held, battery-operated voice recorder was used. As far as possible, I wanted to have almost no equipment, and certainly no cables and power cords, near the student participant. The video-recording of online activities occurred with software on the laptop computer that the student was using for the task, and thus happened in the background and allowed the student to be alone, rather than have a camera and perhaps a camera operator in the room also.

3.5 Ethical issues

The proposed research involved students aged 14 to 17 years who attended the school at which I was a teacher; this required that I did not take unfair advantage of the position of influence in my relationship with them. Therefore, I sought and obtained approval (No. HE07/181) from the UNE Human Research Ethics Committee to undertake the research.

Consents from participants and their parents were obtained before data were collected and analysed. Pseudonyms have been employed when referring to students. I gained the consent of the school's principal and participating teachers to proceed with my research activities.

Students were informed orally and in writing, and their parents were told in writing (see Appendices 3.1 and 3.2), that participation was entirely voluntary and that anyone who chose to participate was free to withdraw at any point in the study without penalty. There were also no negative consequences for students who elected not to take part. The researcher took care not to give any impression of compulsion or obligation to participate. For example, when students who had participated in Study 2 were invited, through a note sent via their tutors (see Appendix 3.5), to participate in Study 3, but did not respond, I did not approach them in person, out of a concern that they may have felt an obligation to take part.

The information collected from the students was not of a particularly personal or sensitive nature. It was therefore unlikely that any aspect of the research would have made students feel uncomfortable. In the unlikely event of discomfort, however, students had access to the school's counsellors.

At all times, an open, honest relationship with students was maintained. Any questions they had were fully answered, and at no time was any attempt made to deceive them about the purpose of the research, its conduct, or the use to which its findings would be put.

All data will be stored confidentially and retained for a period of no more than five years, after which they will be destroyed. Data in electronic format will be protected during the storage period by requiring the researcher to login using a user name and password known only to him and, in the case of computer equipment at his place of work, to authorised staff (generally IT staff). The researcher's privately owned computer equipment will generally be

locked in the private residence of the researcher; when taken from the researcher's residence, the researcher will ensure the security of the equipment and not permit unauthorised access to the data stored on it. Any data stored in hard copy format will be kept securely in the office of the researcher at his place of employment, or locked in the researcher's private residence.

3.6 Educational context

A three-part investigation was undertaken into the ISP of secondary students drawn from a school in south-eastern Australia, hereafter called 'the school'. The three parts will be referred to as Study 1, Study 2, and Study 3. Study 1 represented a broad approach to determining students' experience of the ISP; Study 2 entailed a more focused approach, in that it was narrowed to a closer investigation of students' relevance and reliability criteria; and Study 3 was undertaken to fine-tune data collection procedures.

Participants were sought from classes of students in Years 9 to 11, aged 14 to 17. Year 12 is the final year of secondary schooling in Australia but I avoided seeking participants from this group out of concern that their involvement in the study may interfere with academic progress. All data collected related to information search tasks undertaken by students as part of their courses of study. Students were English-speaking and there was considerable homogeneity in their cultural backgrounds. All students were Australian-born, except one born in China; ancestry was predominantly European, although three students (including, obviously, the one from China) had an Asian ancestry. They were from predominantly middle-class families whose parents were well-educated (approximately 95 per cent of parents of students at the school having a post-secondary qualification, with 80 per cent of parents holding a Bachelor's degree or higher degree); and parents surveyed in 2011 reported a very high level of satisfaction with the school. The independent school the students attended charged fees considered mid-range. The students were academically able and none had special educational needs. Being within the high academic range may render the study's findings applicable only to students within that range.

Students had access to a school library that included computers with intranet and Internet access. Through the intranet, students were able to search online databases to which their school subscribes; these databases were specific to school subjects, and so included specialised subject encyclopaedias, but also included general encyclopaedias and databases covering current affairs. Most students also had access from home to information sources via the Internet, including those sources available by logging on to the school's intranet.

In summary, the students of the school have high academic expectations. They come from homes where learning is valued and where academic excellence is encouraged. There is a high level of tertiary education among the parent body. Parents are keen that their children achieve a high University Admission Index (UAI) (and, subsequently, the ATAR, the Australian Tertiary Admission Rank), a system used by universities across Australia to determine entrance to universities and to particular faculties within universities. The non-selective school's students consistently achieve high UAI /ATAR scores: in a scheme in which the highest mark available is 99.95, the median ranged from 87.7 to 92.0 over the period of the study. Participants Gerard, Lionel, Paul and Sophie, for example, achieved an ATAR of 99.0 or greater.

3.7 Participant recruitment

Participants were recruited from the school in which I was working at the time. Two factors motivated the recruitment of a convenience sample: the first was that my research findings were intended to inform a local audience who have demonstrated suspicion of research findings that are outside the context of their immediate one; the second was that it was not realistic, in terms of my time and other resources, to investigate other contexts as a part-time researcher employed full-time as a teacher librarian.

Recruitment of student participants was by one of two methods, the first of which was a presentation (3 to 5 minutes) to a class or a year-level assembly telling students that I was researching the information searching activities of students, and referring to my methods of collecting data. My presentation concluded with an invitation to participate and to take home to their parents or caregivers an information sheet about my research activities and also a consent form for parents and an assent form for students (see Appendix 3.2). Most volunteering students responded to this first method of recruitment. The second recruitment method was more direct in that I approached individual students I knew from their participation in the school's debating program and whom I considered likely to be articulate about their learning experiences. I employed this second method to recruit male students as I found that, in Study 3, all the students who had agreed to participate a year later were female and there was a risk of male students not being represented at this stage. I speculated that either all the boys felt uncomfortable giving voice to their learning experiences, or they considered that they could not commit the time to the study, or both. Because the latter recruitment method did not entail approaching students who had taken part in Study 2, I did not consider the method to risk being construed as a form of pressure from a teacher on a student.

I was fortunate not to be faced with the challenge presented by the 'less articulate, shy interviewee' who produces 'less than adequate data' (Cresswell 2007:133). A process of self-selection appears to have been in operation, that is, only those students that were confident that they were able to provide pertinent data, and felt comfortable in a one-to-one interview situation, elected to take part.

Study 1 functioned both as a pilot study and a means by which to uncover phenomena of

interest in the ISP of students. A combined total of thirty-seven students took part in three studies. A different set of participants took part in each of Study 1, Study 2, and Study 3, except that four girls (Chloe, Karen, Sophie and Victoria) took part in both Study 2 and Study 3, and one boy, Paul, contributed two separate sets of data during the course of Study 3. The pseudonymised names of the participants are to be found in Tables 3.4 (Study 1), 3.6 (Study 2), and 3.7 (Study 3). (My attempt to elaborate further on the number of participants is seen in a journal extract at Appendix 5.1.7.)

Studies with approximately the same number of participants as my study include: Choi and Rasmussen (2002); Hughes, Wareham and Joshi (2010); Joachims, Granka, Pan, Hembrooke, Radlinski and Gay (2007); Kim (2010); O'Brien and Keane (2006); Robins, Holmes and Stansbury (2010); Sundin and Francke (2009); Taylor, Zhang and Amadio (2009); and Westbrook (2006). There appears to be widespread acceptance in the field of information behaviour that valid conclusions can be drawn from groups of this size.

3.8 Study 1

3.8.1 Participants

Sixteen Year 11 students volunteered to take part in Study 1: seven girls and nine boys, aged about 16 to 17 years. I was confident that the oral and written skills of these students were sufficient to communicate their experiences. I expected such a purposeful sample to 'yield the most information about the topic under investigation' (Leedy & Ormrod 2005:145). Appendix 3.10 shows the interview schedule of the full study.

The class of twenty-one students (sixteen of whom participated in the study) had been constituted for the purposes of a unit of study called History Today in a subject called Contemporary Issues. This unit, involving about fifteen hours of class time over the second semester of 2007, required students to select a significant event (or phenomenon, such as a social trend) in current affairs and to explore its relation to events past. It was a particularly appropriate unit to form part of this investigation because of the extensive information searching that students undertook, the student-directed choice of topic within a broad framework, and the high degree of independence students experienced while exploring their selected topic. The breadth of choice made it more likely that the student would engage in a topic of personal interest. Table 3.4 below shows the pseudonymous students, all of whom were in Year 11, who participated in Study 1, and their chosen topics.

Student	***Topic***
Brian	From quill to digital pen
Daniel	Racism (Aborigines, the Holocaust, Native Americans)
David	War on the waterfront and WorkChoices
Ethan	Seatbelts and airbags (worked with Ryan)
Kathy	Marilyn Monroe and Paris Hilton
Kelvin	Apple iPod versus Sony Walkman
James	Pirates and ninja
Jenny	McCarthy Communist trials and the Salem witch trials (worked with Mia)
Lara	*Grease* and *High School Musical*
Lily	*Lord of the Rings* and *Harry Potter* (worked with Noah)
Maria	Bosnian genocide and the Holocaust (worked with Vicki)
Mia	McCarthy Communist trials and Salem witch trials (worked with Jenny)
Noah	*Lord of the Rings* and *Harry Potter* (worked with Lily)
Robert	Wars in Vietnam, Iraq and Afghanistan
Ryan	Seatbelts and airbags (worked with Ethan)
Vicki	Bosnian genocide and the Holocaust (worked with Maria)

Table 3.4: Participants in Study 1 and their topics

Students were given the choice of producing either a 1000-word essay or a 15-minute presentation on their chosen topic. Students were able to work individually or in pairs for their oral presentation and also kept a reflective journal of their learning experiences.

While the class was a mixed abilities class, my impression, and that of the subject teacher (referred to by a pseudonym, Louise), was that the proportion of students with low abilities was less than a quarter, with about a quarter of high-ability students.

The particular class from which the sample was drawn was chosen for several reasons. I have an excellent working relationship with its subject teacher, with whom I work in another department of the school. The head of the Humanities Department, through which the subject is offered, was most co-operative. The subject is not taken into account when calculating students' UAIs, and thus any concern that students' involvement in research activities may compromise their scores would not arise. That I was a member of staff brought a level of familiarity that made students more comfortable with me than a researcher from outside the school.

I attended some classes to explain my research interests, inviting students to participate but stressing that their participation was voluntary and could be in part or in full. I explained what the journal should contain, giving an example of an entry that I would make. I explained that, in both the interviews and the journals, I wanted them to be honest and not to tell me what they thought I wanted to hear but to tell me their story 'warts and all'. This contact was part of developing rapport with students. I also had email contact with their parents to explain the research study and to answer any questions that they had.

One factor that may have made the class less suitable for investigation was the protracted nature of the class schedule: about fifteen one-hour lessons spread out over a semester of about nineteen weeks. The lack of continuity had the potential to impact on journal writing, as students picked up and put aside their information research activities. Noah, in his quaint journal entry, illustrates the effect of long gaps between classes: 'Whenever I come to class with a dogged intent to work, I have nigh on forgotten the majority of my work from last lesson'.

The ungraded result in the course may have led to less effort being made by students than they would have made in courses where the grade was included in the calculation of their UAI scores. Noah alludes to this:

> Well, I know that I'd use different research methods for other topics, like, for Contemporary Issues, you just want to get it done with and get a passable sort of mark whereas with History essays or seminars or anything then you, your researching is a bit different and more comprehensive.

The comments of the parents of two students who chose not to participate have a bearing on the sample: '[Name of student] advises me that he is not interested in participating. That might well be because his study habits are not the best!' and '[Name of student] … questioned whether she was a suitable subject. She is not the most diligent of students!' These two students assumed that only informants who had exemplary study habits were worthy to be studied. This may have had the effect of skewing the results in that such students (less diligent) would not have been well represented. Students who were not confident in their academic skills and also reluctant to participate were mainly unwilling to take part in the face-to-face interview. Some of these students and their parents, however, agreed to have data from questionnaires and journals included.

3.8.2 Data collection (Study 1)

Data were sourced from one-to-one interviews, students' journals, and their responses to two questionnaires. Of the sixteen students taking part, ten attended an interview, ten wrote a journal, and fifteen responded to at least one of the two questionnaires (five responded to both, while ten responded to one). The average participation rate across the four data collection events was 48 per cent, although 76 per cent of the class participated by contributing to at least one of the four data sources. The variations in completion of the data collection instruments was not a particular concern to me, both because I considered Study 1 to be a pilot study and because I felt I had gathered sufficient data, in similar proportions, across the different types of instrument. The participation of each student is displayed in Table 3.5 below, where I use the pseudonyms I assigned to the students.

Student	*Interview*	*Journal*	*Questionnaire 1*	*Questionnaire 2*
Brian	Y	Y	Y	Y
Daniel	Y	Y	Y	Y
David	N	Y	Y	N
Ethan	N	N	N	Y
James	N	Y	N	Y
Jenny	Y	N	N	Y
Kathy	Y	Y	Y	Y
Kelvin	Y	Y	N	Y
Lara	N	Y	Y	Y
Lily	Y	N	Y	N
Maria	Y	N	N	Y
Mia	N	Y	N	Y
Noah	Y	Y	N	N
Robert	N	Y	Y	Y
Ryan	Y	N	N	Y
Vicki	Y	N	N	Y
Total	**10**	**10**	**7**	**13**

('Y' indicates data contributed by relevant student)

Table 3.5: Participants' contributions to various data collection methods in Study 1

Students wrote reflective journals about their experiences of the ISP related to the research task assigned in a Contemporary Issues class. Students were encouraged to describe their actions, thoughts and feelings in as much detail as they could; and to describe clearly what they did, how they went about the task and why they took actions related to their research task. Guidelines for writing the journal were distributed to students and can be found in Appendix 3.6. This type of self-reporting is a distinctively qualitative approach to gathering data.

Entries in journals and discussions in interviews required retrospection: they attempt to describe and make sense of something after it has happened. They also required from participants a measure of introspection, an awareness of and an ability to analyse their own behaviour. Brown and Pressley (1994:170) voice a concern about the interpretation of metacognitive interview data: 'that such data reflect more whether students can talk about cognitive processes rather than whether they can and do use them'.

The purpose of the reflective journal was to give students an opportunity to write about their actions, thoughts and feelings as they progressed through their research task. While the interview was structured by the interviewer's questions, the main reason for using journals to collect data was to allow students the freedom of an unstructured means of expressing their experiences. In this way, data from the interviews would complement journal data, giving more scope for students to give a fuller picture than the use of interviews alone. There was a high degree of consistency between journal content and interview content.

The interviews were focused, or semi-structured. The topics that guided the interviews, if somewhat broadly, appear in Appendix 3.7. The average length of an interview was 11 minutes. Full transcriptions of interviews focused on producing a written record of students' words without including excessive details of intonation or other aspects of prosody. As my study was not a conversation analytic study, and therefore did not aim to 'produce descriptions of recurrent patterns of social interaction and language use' (Peräkylä 1997:202), such transcriptions were appropriate.

The strength of using interviews, as opposed to observations of in-class behaviour, is that they are more effective and efficient in achieving the following:

- establishing students' motivations for their selection of topics;
- identifying how they incorporated prior knowledge with new knowledge;
- examining how they synthesised information from a variety of sources; and
- ascertaining what their purposes for presentation were.

While some of these activities may be observed in the field, constant and intrusive questioning would be needed in order to establish thinking processes behind actions. 'Think-after' protocols, in the form of video-stimulated recall interviews, were used in Study 3 to gain an insight into students' cognitive processes.

Most students preferred the interview as a data collection method. The advantages noted were that the interview made them think more about their approach; it was face-to-face and on-the-spot, and therefore less prone to being edited to make its content appealing to the interviewer; it captured the variety of strategies used by students; and was 'less work' for students than, say, writing a journal.

Two questionnaires were administered: one soon after most students had selected a topic for investigation, and the second approximately halfway between the time the task was assigned and when it was due for completion. The questionnaires contained sufficiently broad questions to elicit data about students' learning strategies, along with what may have been challenging for them at the respective points of the questionnaires' completion, and their experiences of success at those points. Data from only two of the questions from each of the two questionnaires (Appendix 3.8) were analysed. On each occasion, students completed the questionnaires in class. Students were allowed to talk to each other about their responses.

Questionnaire responses lacked detail; for example, in response to a question about what the student found difficult about research, an answer was 'finding additional information'. Such a response lacks details about what the purpose of the additional information (was it to corroborate already found information or did the student have the feeling of not having gathered enough?), and details about the topic or subtopic area(s) in which the information was required.

Another weakness was that the responses in the questionnaires, or reflection sheets, focused strongly on locating information. Interviews gave students the opportunity to provide more information than questionnaires, that is, to compensate for the weaknesses I identified. The interviews succeeded in shifting attention from locational activities to garner a wider range of aspects of the ISP.

3.8.3 Data analysis (Study 1)

I examined data from the questionnaires, the interviews and the journals. I used only responses to Question 4 in the questionnaires, about what students found easy about their research, and Question 5, about what students found difficult about their research. See Appendix 3.8 for the full form of the questions.

I allocated categories to segments of data that I considered were illustrative of particular aspects of information behaviour, such as finding information: selecting information; and verifying information. Each category was regarded as provisional until further examples of that category were found in the data of other students. Categories were redefined, renamed

and discarded as analysis proceeded. Interview data were coded as soon as possible after each interview was completed. Codes developed during analysis of the interviews were applied when analysing journal data. Few new codes were developed when the journal data were analysed, indicating that categories were approaching saturation at that point. TAMS Analyzer software (Weinstein 2004) was employed to assist with the coding and analysis of data.

When categories were grouped into superordinate themes, the following four emerged: the student in his or her socio-academic context; constructing meaning; using resources; and finding topicality. (I use 'socio-academic' to mean the combined social and academic contexts of the student, including the social relationships that are experienced in academic activity.) The first theme indicates the environment in which the activities of the other themes take place. A student's activities in a socio-academic context related to interactions with teachers, parents, siblings and other students. In the second set of themed data, students processed new information and sometimes grafted it to prior knowledge, and a new product emerged that was constructed in a way that facilitated the understanding of its message by the student's audience. Students used free Internet resources, relying mostly on *Google* and *Wikipedia*, as well as printed books. Students established topicality by examining the information resource for relevance to their self-selected topic; the reliability of information was confirmed when it could be regarded as redundant through having been found in another source of information.

3.9 Study 2

3.9.1 Participants

In the second study, students taking part were drawn from two History classes at middle secondary level: one at the Year 9 level and the other at the Year 10 level. They ranged in age from 14 to 16 years old. Nine girls and five boys took part. None of the students taking part in Study 2 had taken part in Study 1. The two History classes were selected in order to examine whether younger students than those in Study 1 would exhibit a similar ISP; in particular, whether they would employ similar means of deciding relevance and assessing information quality. They were also the classes of a colleague supportive of research activities, as was his head of department. I negotiated with my colleague to allow students time from his classes to attend data gathering events. The schedule of interviews for all three studies making up the present investigation may be found in Appendix 3.10.

Participating students and their selected topics are shown in Table 3.6 below.

Student	***Year level***	***Topic (in the student's own words, as far as possible)***
Amber	9	The role of women during the Second World War in Australia
Charlotte	10	The movie *Dream Girls* and how that relates to the 1960s
Chloe	9	A great Australian from the period of 1718 to 1918: Matthew Flinders
Elizabeth	10	The parallels between the 1936 Olympics in Berlin and the 2008 Olympics in Beijing
Emily	10	Dada and surrealism
Jake	10	During the 1920s and 1930s, was the treatment of African Americans similar to that of German Jews?
Karen	10	Stalin and his war leadership
Kristian	9	Why the gold mining boom of the 1800s is important
Mark	10	Why did the Japanese attack Pearl Harbour and how did this affect the European war?
Michael	10	Were the nuclear bombings of Hiroshima and Nagasaki necessary?
Rachel	10	Why the USA dropped the atomic bombs on Hiroshima and Nagasaki and was it justified?
Richard	9	Whether or not Anzac Day is a fraud, if the Gallipoli campaign was a military disaster
Sophie	9	The importance of the gold mining boom of the mid-1800s to Australian history
Victoria	10	Why the atomic bomb was dropped on Japan and whether it can be justified

Table 3.6: Participants in Study 2, their scholastic year level, and their topics

3.9.2 Data collection (Study 2)

Interviews were used to gain an understanding of the experience of each participant as he or she progressed through the finding and using information sub-task to complete a History task. Interviews were expected to yield valuable individual perspectives of a similar task; offer more detail than other methods; and to give the interviewer an opportunity to explore points related to the research questions that seemed important to the participant.

A set of interview questions was used as a guide (see Appendix 3.9). The interview guide questions included 'What, or how much, did you know about the topic before beginning your research?' which was designed for students to offer an assessment of their prior knowledge of the topic. The central interview question was Question 3 in Appendix 3.9, in which the participant is invited to consider an imaginary timeline of the steps taken to complete the assignment; Questions 6, 7 and 8 were important in the investigation of the interrelationship between found information and used information:

> *Question 6*: What sources of information were most useful?
> *Question 7*: How did you decide which sources were good for your research assignment? What factors did you use to judge whether a source was good or not?
> *Question 8*: If you came across sources that you disagreed with, or two sources that contradicted each other, how did you handle that?

Interviews took place when students had completed their information research task, as far as possible. In cases where students had not completed the task, they were invited to relate their answers to previously completed History tasks. Each interview lasted about 15 to 20 minutes; it seemed unrealistic to expect the target group to remain focused for longer than this.

Study 2 used a structured interview approach with its pre-formulated questions asked in the same order for each participant. I am inclined to agree with Fontana and Frey that a drawback of such an interview type is that it taps cognitive rather than affective states: it 'often elicits rational responses, but it overlooks or inadequately assesses the emotional dimension' (2003:70). It may also invite rationalisations that may not reflect the thinking processes that participants employed in relation to the experience that they attempt to describe. Participants may also consider hypothetical situations, rather than ones that they have actually

experienced; for example, if the question related to a situation which participants either had not experienced, or could not recall having experienced, they possibly imagined what they would do if faced with the situation described by the interviewer, rather than indicate their lack of experience of it. Such a response from an adolescent to an adult interviewer appears quite likely.

I also attempted to use video screen capture software to record information-related behaviour of a group of students simultaneously. I abandoned that approach, however, after finding that it was not feasible to interview students immediately after their experience, thereby not collecting data relating to incidents that could be readily recalled. I concluded that computer-based activity would need to be gathered from a single student at a time, with an immediately following interview with that individual student that used questions based on my research questions. This is the approach I adopted in Study 3 (see below). The logistical difficulties of interviewing a sizable group of students individually, while their information search and use activities were still fresh in their minds, could not easily be overcome in Study 2, except perhaps by collecting screen captures from ten students early in the day and then taking half an hour for each student to participate in a retrospective interview during the remainder of that day. This would require my taking of a day of leave and interruption to two classes for each participant, when I felt that my employer had already been generous about facilitating my research activities.

3.9.3 Data analysis (Study 2)

In the first step of analysis, I assigned what are termed ‘free nodes’ in QSR International’s (2008 and 2010) *NVivo qualitative data analysis software* (*NVivo* hereafter). (Nodes in *NVivo* are containers for themes, that is, places where themes are stored.) Essentially, this entailed assigning thematic categories to any phenomenon in the data I considered of interest, bearing in mind my research questions. I did not, however, restrict myself to noting data that answered my research questions. I found that segments of data that did not appear immediately to have a link with relevance and reliability judgements sometimes subsequently had some connection with the processes of such judgements. Openness to other data is an important aspect of analysis in developing a grounded theory; an initial analysis that is too focused may exclude the consideration of data that may provide evidence for, or against, an emerging theory.

The second stage of analysis involved the allocation of 'tree nodes' in *NVivo*. This required the clustering of themes revealed in the free nodes, so that free nodes were grouped in related clusters. I treated each tree node as a superordinate category; the free nodes that I related to each tree node became subordinate when grouped under the heading of a tree node. In Version 8 of *NVivo*, the nodes that I have called the subordinate nodes are called tree nodes by the software developers; in other words, the developers have conceived of tree nodes as having other tree nodes subordinated to them. Interestingly, Version 9 of *NVivo* has discarded the distinctions between types of nodes.

In a third stage of analysis, I found that some subordinate categories could be analysed at a finer level and so I developed categories to cover these. A main tree node called 'Relevance', for example, had a subordinate tree node of 'Sorting relevant from irrelevant information'; when I found that the sorting process happened at four main points in the ISP of students, I assigned four tree nodes under the subordinate one to record my analysis. While I discarded this particular node and its four subordinate nodes in subsequent analysis, especially after the collection and analysis of data for Study 3, Appendices 4.1 and 4.2 portray the hierarchical structure of nodes I employed. It should be noted that the appendices show a stage of analysis that informed the reporting of the investigation's findings, rather than prescribing which findings I considered of most importance.

3.10 Study 3

3.10.1 Participants

Ten Year 11 students and one Year 10 student, six female and five male, volunteered to take part. Participants in Study 3 gave up non-class time to record their information search and use behaviour and to attend an interview. Most attended during periods designated as study periods in their daily timetable of classes; however, some used other times, such as the end of the school day. This was in contrast to participants in Studies 1 and 2, who attended during class time. An interview schedule for all three studies may be found in Appendix 3.10.

For many of the participants, almost a year had elapsed between Study 2 and Study 3, so I considered the consent of parents and the assent of the students to have lapsed. I therefore approached the parents of the participants to 'refresh' their agreement for their children to participate and found them happy to do that (my request, by email, is reproduced in Appendix 3.4). The girls in Study 2 were generally willing to join Study 3; however, the boys from Study 2, even though their parents had given consent for their further participation, appeared either unwilling or unable to become involved. Some boys may have taken part had I approached them face-to-face, instead of by email and a note passed to them via their tutors; however, I regarded this as an action that may have led to the boys feeling a stronger obligation to participate and, if so, would have amounted to pressure in the context of the power dimensions of the student-teacher relationship.

Table 3.7 shows the students who took part in Study 3, along with their year level at the time, and their chosen topics.

Student	***Year level***	***Topic***
Chloe *	10	The Battle of Singapore
Edward	11	Three criminals and their mental health
Gerard	11	The future of mining: a case study of the Chakola mine
Karen *	11	Advantages and disadvantages of slaves in ancient Roman society
Lionel	11	Franz Kafka's *The Trial*
Mary-Ann	11	The physics of greenhouses
Paul	11	Beethoven
Paul (2nd contribution to Study 3)	11	Preparation for a convention on the Australian Constitution: Australia as a republic
Sharon	11	Advantages and disadvantages of slaves in ancient Roman society
Sophie *	11	*The Reluctant Fundamentalist* by Mohsen Hamid; Origins of the Cold War
Stefano	11	The Falklands War
Victoria *	11	What McCarthyism displayed about American attitudes in the 1950s

** These students also participated in Study 2.*

Table 3.7: Participants in Study 3, their scholastic year level, and their topics

3.10.2 Data collection (Study 3)

The interview sessions were held in a classroom that forms part of the school library building, a room familiar to students. I was the only researcher conducting the interviews. In the classroom, a laptop computer, connected to the school's network, was provided for students to use. *Screenium,* a screen recording application, had been installed on the networked computer. A digital voice recorder captured the student's think-aloud report and the subsequent retrospective interview. I used iTunes and QuickTime Player 7 to play back .mp3 files.

For the concurrent/think-aloud report, students were given the following instructions, or words to similar effect:

- While working on your assignment, I want you to think aloud. Try to give a running commentary of what you're thinking about and feeling, with as little silence as possible.

- Have you done something like that before? *Yes* – OK / *No* – just try to say what you're thinking as you're doing things – your thoughts and feelings.

- After about 20 minutes, I'll come in and we'll look at the recording together. While we're doing that, I'll ask you about the decisions you made while working on your assignment.

In the retrospective interview that followed the students' working on their assignments, participants were asked preliminary questions about their chosen topic and their level of prior knowledge, in order to frame the interview. The bulk of questions were enquiries about decisions that they had made about the relevance and reliability of the information that they had found. This took the form of asking questions about what led them to choose the particular information resources that they had (to ascertain the bases of their relevance judgements), and enquiring about factors that led them to consider particular information resources, from those found, to be reliable sources. Interspersed with these questions, but with a low-level emphasis, I asked students to comment on their feelings while undertaking the task. Their feelings included those in Table 3.8. See Appendix 3.12 for data extracts relating to affect. Although my focus was on cognitive activity, rather than on affective states, I did not wish to ignore the role of affect in cognition.

Feelings	***Stimuli***
Disturbed	Horrific images Poor treatment of indigenous peoples
Anticipation of satisfaction	Expecting successful communication of a message
Sense of wonderment	Finding a fascinating piece of information
Excitement	Making connections with prior knowledge Finding sufficient relevant information
Impatience	Not finding, in a short time, information needed
Confidence	Evaluation of research skills
Sympathy	Reading of murderer's difficulties during childhood
Frustration	Technology not operating smoothly Conflicting information Having to cut out material to meet word limits

Table 3.8: Selection of participants' feelings

When giving participants instructions related to the concurrent/think-aloud report, I deliberately told them that I would be asking about their decisions, keeping the focus of my investigation as general as possible. My approach was based on a desire to collect data that were as spontaneous as possible, and that reflected the students' experience as far as possible, without introducing the possibility that they would be focusing on judgements of relevance and reliability, had I indicated that these were the focus of my investigation. I hoped that this would also reduce the chances that participants would tell me what they thought I wanted to hear, for example, by attempting to portray themselves as model users of information, following 'textbook' approaches to the evaluation of information sources that they may have absorbed from teacher-led guidance, but which they may not have put into practice.

3.10.3 Data analysis (Study 3)

Think-aloud reports and retrospective interviews were transcribed from their digital recordings for examination along with data from the screen recording software. I transcribed the reports and interviews as soon as possible after each session, thus gaining an immediate familiarity with the data. I then systematically analysed the data using the techniques for constructing grounded theory described by Charmaz (2006) and others, particularly Dey (1999). This entailed allowing themes and concepts to emerge from the data, rather than using an *a priori* code book. I was assisted in the process of analysis by *NVivo* qualitative data analysis software. Appendix 3.13 offers examples of data analysed. I also prepared process sketches of each student's approach and an analysis of the data relating to each student, as those data pertained to the research questions (see Appendix 3.14). The analysis of data related to the research questions was generally undertaken three months or more after the software-assisted analysis. Such analysis, done without reference to the earlier analysis, functioned to look at the data afresh, and thus see additional or different aspects of the data; it also provided a useful visual display of the strategies employed by each student that differed from any I may have been able to gain from the software package.

3.11 Chapter conclusion

The purpose of this study, influenced by a grounded theory approach, was to describe the decision making processes, in relation to the relevance and reliability of found information, of a group of secondary school students at a school in south-eastern Australia. A literature survey identified school students as a population about which little knowledge has developed.

My study, particularly through its qualitative methodology, accepts the subjectivity of interpreted experiences of its participants. While I agree with Alvesson and Sköldberg's (2009) assertions that researchers are always working with mediated facts, I am not concerned by what they perceive as an attendant risk: that grounded theory may result in a theory that unifies the collective theories of participants. The data that my investigation collects are mostly interpretations by students of their experiences of the ISP, and its findings may be considered to be interpretations of those interpretations. While semi-structured and structured interviews are likely to have produced the most subjective interpretations, through the use of screen capturing software, an attempt was made to elicit segments of data that could validate the students' experiences. A video-stimulated recall interview following students' ISP activities was able to draw on students' just-experienced interactions with information; captured video data not only offered specific and tangible illustrations of students' claims made in the subsequent interview, but also offered the investigator specific and tangible experiences about which to ask questions related to students' perceptions of relevance and reliability.

The method of the current study aspired to elucidate the strategies used by students to evaluate the relevance and reliability of information. It set out to be a descriptive study; in addition, as one of few investigations with an explicit focus on this aspect of the ISP, it should be regarded as exploratory. Such a study may be expected to produce low-level theory, in that its findings will include theoretical categorisations of phenomena described at quite broad levels (see Section 3.2 above).

While my study began with a broad exploration of the ISP of students (Study 1), it progressed to a study to determine how students 'promoted' found information to used information (Study 2), a study in which it was hypothesised that students' judgements that information was relevant and reliable underlay their use of found information. When I concluded that the structured interviews used in Study 2, depending as they did on the recollection of students' interactions with information, did not offer validations of their interactions, I decided to employ alternative methods. In Study 3, therefore, I used screen recordings of online activity and followed these (immediately, for the most part) with interviews that entailed a viewing of the screen recording by both participant and researcher, with the researcher asking questions related to judgements about relevance and reliability about the specific information resources used by the student for his or her research of a selected topic area. The research questions, as well as the methods used to investigate them, therefore evolved in response to my observations of the phenomena of interest.

CHAPTER 4: FINDINGS: DECISION MAKING IN RELATION TO RELEVANCE AND RELIABILITY OF INFORMATION

4.1 Introduction

This chapter presents the findings of the study in relation to the decision making of participants who were undertaking information search tasks. In the previous chapter, I related how thirty-seven students between 14 and 16 years of age from a school in south-eastern Australia participated in a three-part research project that ran from mid-2007 to late 2010. The study collected data from students' journals; structured and semi-structured interviews; think-aloud reports; video screen captures; video-stimulated recall interviews; and questionnaires. The study's research questions focused on the criteria used by students to decide on the relevance and reliability of the information with which they were interacting, and considered the context in which such decisions were made. The grounded theory that flows from the study may be found in Section 5.7.

The current chapter discusses the study's findings, an outline of which follows. The students in the participating group made decisions at two major points about the relevance and reliability, respectively, of information: when examining the search results returned by a search engine (universally *Google* in the current study); and when examining an individual information source that, in the case of online sources, had generally been accessed by clicking on a hyperlink in a set of search results. I have used 'pre-access' to refer to the former, and 'post-access' to refer to the latter. Pre-access relevance judgements are further subdivided into: those that are provided by the search engine, which I refer to broadly as an information system; and those that require the exercise of a more subjective assessment than the data provided by the information system to assist in the decision making of the user.

Data were analysed with the assistance of QSR International's (2008 and 2010) *NVivo qualitative data analysis software*. The process of data analysis began with a transcription of all questionnaires, interviews and think-aloud reports; these transcriptions were then copied to the computer program, along with students' journals. I then read all these data sources, noting segments of data that related to relevance and reliability judgements. Such segments were assigned one of the two broad 'codes', or themes, of 'relevance' and 'reliability'; the two

broad themes were subdivided into subcategories created under each of these two themes. Such subdivisions were assigned and named as I interacted with the data; that is, codes were not assigned *a priori*. Occasionally, these subdivisions were further categorised into sub-subdivisions. Thus, a hierarchical grouping of codes was developed. The resultant code structure for the theme of relevance can be seen in Appendix 4.1, while that for the theme of reliability is presented in Appendix 4.2. The hierarchical groupings shown in these two appendices guided, rather than prescribed, what I considered important enough to include in the current report.

The code structures in Appendices 4.1 and 4.2 were subsequently modified when the framework matrices in Appendices 4.3 to 4.7 were developed. In the latter set of appendices, the new codes appear in bold italics above each data extract. One example of a new code is 'Reputation of source's reliability based on a generalised personal belief', which appears under the socio-academic theme. The codes in the framework matrices were developed when the data from all three studies had been combined, an exercise that necessitated the revisiting of all data, with a particular emphasis on gauging the adequacy of codes assigned to data in Studies 1 and 2. Incidentally, a computer malfunction resulted in the loss of all coded data from Study 1, but no recorded data were lost; the apparent setback proved to be an advantage when the data had to be reconsidered from a fresh perspective.

Relevance and reliability criteria used by participants are outlined in Figures 4.1 and 4.2, respectively. Answers to research questions 1 and 2 (see Section 3.1.1) have been organised around the structure shown in these two figures. The criteria shown in these two figures represent what I consider to be the most 'viable', that is, they were able to sustain a process of description in which only those criteria that, in the hierarchies shown in the appendices, had sufficient depth in the data to survive.

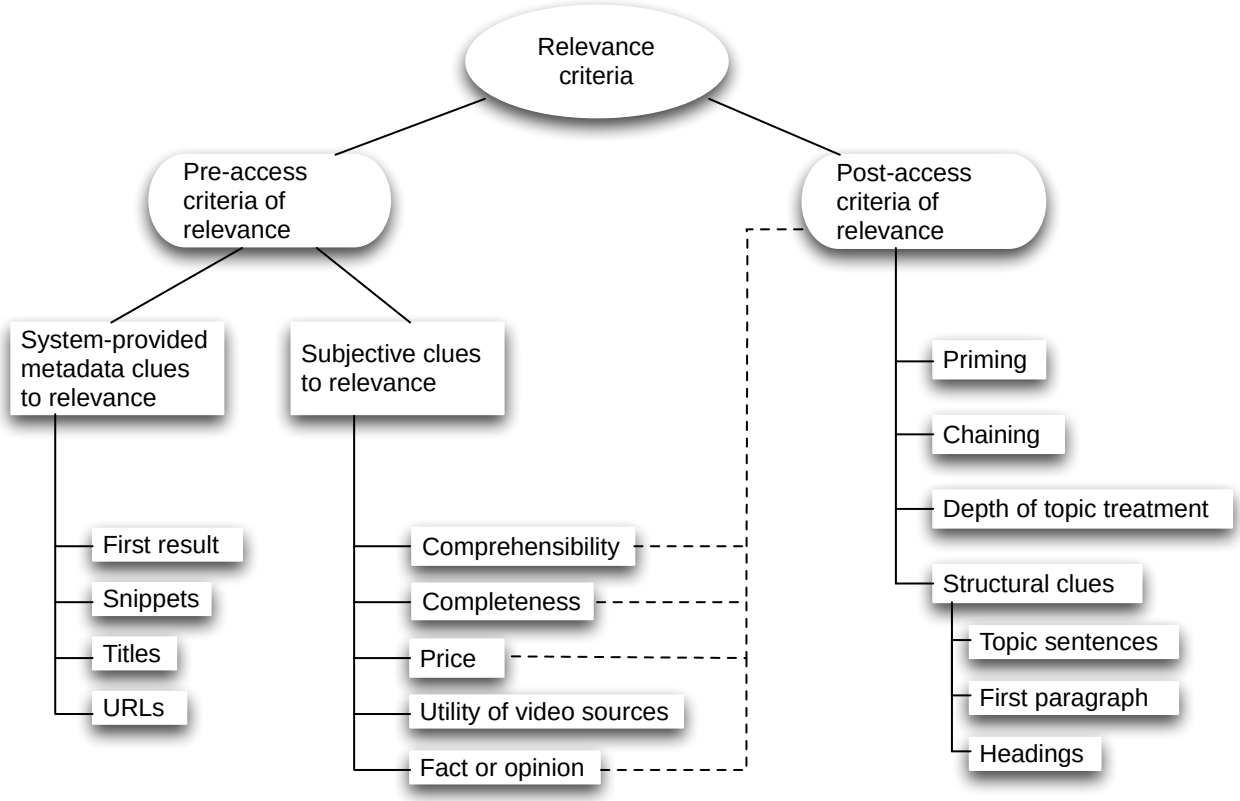


Figure 4.1: Relevance criteria

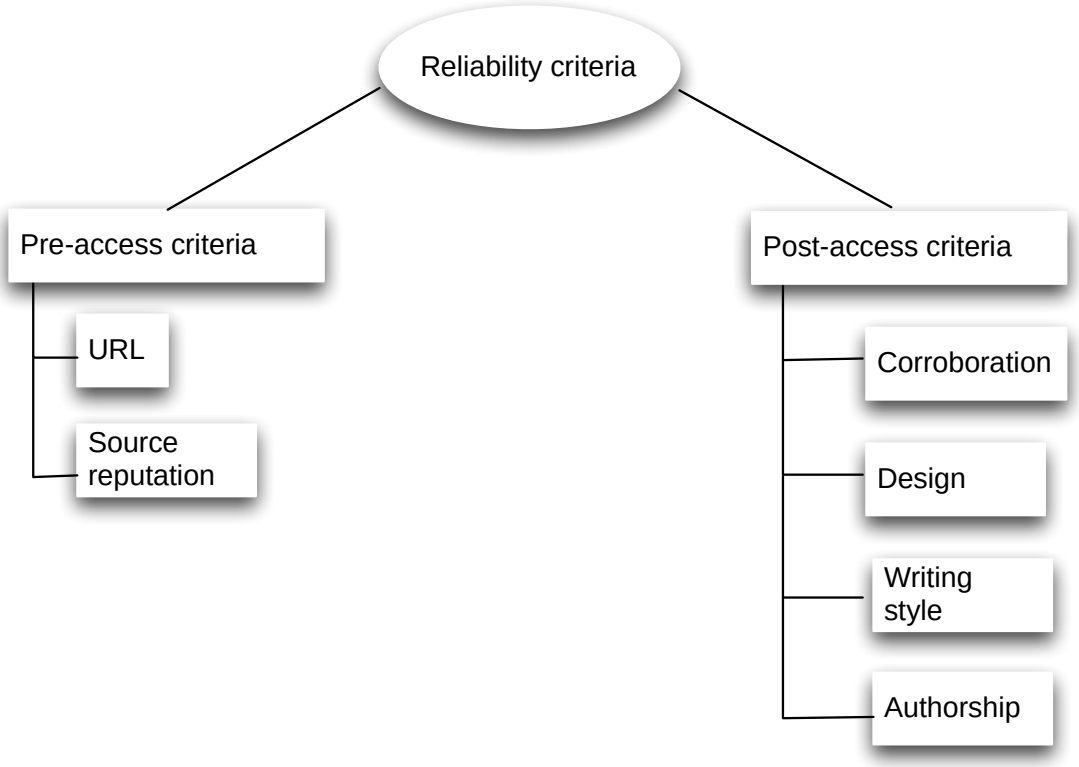


Figure 4.2: Reliability criteria

In the latter part of the chapter, I detail the relationship to research questions 1 and 2 of the themes I identified to describe the context (research question 3). The themes are important to an understanding of the broader context in which students applied relevance and reliability criteria to information found and used while completing assigned tasks. The five themes, beginning with the all-encompassing one, and following with the one that is a thread through all themes, are:

- the socio-academic context;
- convenience or pragmatism;
- relevance priming;
- relevance chaining; and
- building knowledge.

Appendices 4.3, 4.4, 4.5, 4.6, and 4.7 provide matrices that show the relationship between each participant (case) and aspects of the five themes. The matrices contain representative samples of data categorised at each of the five themes; these themes subsume the relevance and reliability criteria displayed in Figures 4.1 and 4.2 above. (For a preview of the visual representation of the relationship of the five themes to the relevance and reliability criteria employed by students in the current study, see Figure 4.9a in Section 4.4.)

While the assignment of labels to segments of data for the purposes of finding answers to research questions 1 and 2 gave rise to an analytic process that 'broke down' the data, the use of what are termed 'framework matrices' in *NVivo* led to a synthesis of data that brought the analysed data back into some more or less coherent whole. The use of framework matrices in Version 9 of *NVivo* is a powerful means of developing a unified structure, once data have been analysed. In particular, the matrices led me to make a more fine-grained analysis of the five themes I had noted as I was able to identify, more clearly, the actions taken within each aspect of each theme. It became more evident, for example, how participants built knowledge within any one of the three aspects of building knowledge that I had noted in the previous stage of data analysis; that is, filtering, matching, and adding could be analysed in greater depth and thus reveal more details of the processes used by participants for building knowledge.

(*Note on use of ellipsis dots in data transcriptions*: When using data extracts, I have adopted the convention of using three ellipsis dots to indicate pauses, '…', but of using ellipsis dots in square brackets, '[…]', to indicate that words have been omitted, either to use only the most salient parts of the extract or because those words were not audible in the recording.)

4.2 Research question 1: What relevance criteria do students employ?

Figure 4.1 outlines the criteria used by participants when deciding on the relevance of a piece of information; the figure also functions as an advance organiser for this section. Two major categories of relevance criteria were pre-access criteria and post-access criteria; the former category refers to those criteria applied before the full information source was examined, while the latter category refers to those criteria used once an examination of the full source had begun. In a pre-access judgement, before a full information source was judged to be relevant or not, it may have been dismissed out of hand for failing to meet some baseline requirement of what a participant believed a potentially relevant source should fulfil. They could, however, equally be termed prejudicial judgements of non-relevance, because the sources are overlooked on the basis of surface features. (I have deliberately chosen to use 'non-relevance', rather than 'irrelevance', reserving the latter for more analytical judgements that the information is not relevant, as opposed to being dismissed before being considered.)

Pre-access criteria have been subcategorised into clues to relevance that are provided by the information system (first or early results, snippets or extracts, titles, and URLs) and those clues to relevance that entail more subjective judgements about the potential usefulness of the information source under consideration. These more subjective judgements relate to the participant's ability to understand the information, whether he or she considers the source to be complete or not, whether a financial cost is involved, whether he or she finds video sources useful, and whether his or her topic lends itself to the use of facts or opinions.

Four post-access criteria of relevance were identified:

- priming, that is, the ability of the source to provide prime information in the form of an overview of the topic that the participant was investigating;
- chaining, that is, the source could be linked to the participant's prior knowledge;
- the depth to which the source treated the topic; and
- the extent to which the information in the source was structured in a readily accessible manner.

When students referred to information that they judged relevant, they used words such as ‘relevant’, ‘good’, ‘important’, ‘interesting’, ‘liked’ and ‘useful’. When they judged the information to be irrelevant, they used words such as ‘not relevant’ or ‘irrelevant’, ‘not useful’, and ‘not needed’. ‘Word clouds’, which present text that is more common in a source as typographically more prominent, are offered in Figures 4.3 and 4.4 to show, respectively, positive and negative references to relevance. Full lists of words and phrases used by participants to refer to relevance, and which were used in the generation of the word clouds, are to be found in Appendix 4.8, which presents positive labels (relevant), and Appendix 4.9, which presents negative ones (not relevant).

Figure 4.3: ‘Word cloud’ of participants’ positive references to relevance

Figure 4.4: ‘Word cloud’ of participants’ negative references to relevance

4.2.1 Pre-access relevance criteria: System-provided clues

I identified a cluster of four related relevance criteria, all of which are a function of the technology behind the search engine, or information system; these were the bases for judgements that issued in the selection of the first result, or other early occurring results, in a set; and in the use of source extracts (snippets), titles and URLs as a guide to relevance. In Watson (2010:6), I referred to 'pre-relevance judgements' but now use 'pre-access judgements' to refer to the same phenomenon. I consider the former label to have been insufficiently descriptive and potentially confusing: the judgements are made before the actual item is accessed; and the judgements are full-blown relevance judgements, rather than judgements that occur before relevance judgements, as the inadequate label suggested.

4.2.1.1 Selection of first result and other early results

Participants routinely accorded substantial relevance to the first result, or other results near the top of the list returned by *Google*, the only search engine chosen by participants. Eleven students used the first result or a result from the first page of results returned by *Google*. Many students selected the very first result (Emily, Karen, Mark, Paul, Sharon, Sophie, Stefano, Victoria; as explained in Section 3.5, these are pseudonyms for the participants). Another student (Charlotte) held the view that most people clicked on the first result but that she read the snippets beneath the titles of websites in the search results in order to work out which sources would be most relevant.

The convenience of selecting the first result was seen in such comments as 'the top one [is] easier to click' and 'with *Google*, the first one normally is the one you're looking for' (Sophie, Interview, Study 3). Emily said, 'I just go into *Google* and type "surrealism" and, um, pick the first one that came up and look through that quickly and see if it had, which it had, what I was looking for' (Interview, Study 2). The word 'just' in the preceding extract, as in the one following, suggested the ease with which students approached the task, relying on the relevance of results that appeared early in the set: 'I just typed in Stalin's war leadership onto *Google* and got a couple of the first sites that came up' (Karen, Interview, Study 2). Victoria clicked on the first result because 'it was the first one on the top of the list' (Interview, Study 3).

Victoria's comment in the preceding paragraph, like the following data from Stefano (Interview, Study 3), indicated that the practice of examining the first result before others may be associated with an almost intuitive response: 'It's just first instinct really. It's what I always generally do. You just put in your topic and see what comes up'. Sharon (Interview, Study 3) also indicated the habitual response that she has to first results, speculating that it was the density of bolded search terms that attracted her to a first result:

> I automatically go to the first one 'cause I think that if it's at the top of the list that it must be the most focused on what I've typed in and also like 'cause it came up in, maybe 'cause it came up with the amount of words that it came up with, the amount of mentioning of slavery and stuff …

On this occasion, Sharon found her heuristic to be lacking, as the first result turned out to relate to information only obtainable via a subscription service: 'something like you had to buy it or something … so I couldn't actually view it'. Nevertheless, the first result was the point at which she began the process of elimination of sources that did not meet her needs.

Stefano referred to his instinctive (automatic, apparently unconscious) attraction to first results, and suggested the notion of an entire resource possessing relevance: 'Normally *Wikipedia* is quite relevant so it just happened to be the first one so I went into it' (Interview, Study 3). His comments also indicate how the convenient assumption that early results offer relevant information is reinforced when the first or other early result is from the familiar *Wikipedia*. Such a trust in *Wikipedia*'s ability to provide relevant information is bound up with the student's search for an overview of his or her topic, that is, the employment of the heuristic that early results will meet one's needs for relevance is reinforced when an early result also meets a specific relevance need, which, in this instance, is to find an introduction to one's area of interest. The effect of a result being the first one and coincidentally being a *Wikipedia* article that could provide an introduction to Australia's 1975 constitutional crisis proved strongly appealing to Paul (Paul2, Interview, Study 3). (In citing data sources, I have used 'Paul' and 'Paul2' to distinguish between the two sets, respectively, of screen capture, think-aloud report and retrospective interview, provided by the participant on two separate occasions. Aware that I was looking for additional male participants, Paul volunteered a second time.) *Wikipedia* is perceived as a trusted gateway to information that is relevant to the

needs of the user, specifically the need to obtain an understanding of the main points of the topic under investigation. Under these circumstances, the notions of relevance and reliability become enmeshed: a *Wikipedia* article becomes a dependable source of information because it has, in the past, been found to provide information relevant to the student's selected topic area.

Participants' use of early results is based on their conviction that results become increasingly irrelevant beyond the first page of results. As Mary-Ann and Stefano, respectively, put it, 'Usually I won't go past the second page of a *Google* search 'cause they just get more and more vague as you go along' (Think-Aloud, Study 3); and 'I generally don't go past the first page of *Google* 'cause it tends to lose, um, what you're looking for […] so why bother going to the next page?' (Interview, Study 3). For recreational purposes, Paul was, however, prepared to go beyond the first page: 'if I really have to find a game, it'll be on the second and third page of a *Google*, but for assignment work, generally on the first page' (Interview, Study 3).

I have focused above on students' reliance on the first result, or first few results, returned by a search engine in response to an entered search string. Students considered these early results to be the most relevant. Students used other features provided by the search engine to assess relevance or to reassure themselves of the relevance of sources to their needs. These are system-provided features that are perceived as relevance clues that are used before the student accesses the source; they include the snippets (extracts from the website), the title of the website, and the URL (Uniform Resource Locator, and for which I use 'website address' synonymously). System-provided relevance clues may also serve to encourage the student to visit the first site, or early sites, in the list of found sources. To that extent, there is a strong association between the student's choice of an early result and his or her response to other system-provided clues to relevance.

The position of an information source in the set of results returned by a search engine influences students' judgements of its relevance. The earlier the result appears, the more highly relevant it is perceived to be. Even though my data do not reveal, in cases where the first result was selected, whether that first site was actually used in the student's final product (such as an essay or oral presentation), results beyond the first page were rarely used. The positioning of a result depends on the algorithms used by the search engine; other factors

provided by the information system also play a part in students' relevance judgements, and these are considered below. The metadata on which participants in the current study depended mostly were: snippets, title, and URL. Snippets are the extracts from websites that search engines typically provide in a list of search results. Titles are of sources supplied in that list. URLs are website addresses. These sources of pre-access clues to relevance are elaborated below.

4.2.1.2 Snippets

Participants examined the snippets, or brief extracts, of sources that were provided by *Google*, in order to judge whether it would be worthwhile to access the full source.

When searching for information about two Australian murderers for a Legal Studies unit in which he was examining the psychology of the criminals, Edward considered the snippet to point to the most relevant source because the names of the two murderers used in his search string appeared in bold. His judgement of the item's likely relevance was based on the appearance of his search terms in bold type: 'it's really just an assumption that there's going to be something relating those two' (Interview, Study 3). The appearance of both murderers' names in the same source gave Edward confidence that the item would contain relevant information. Such collocation of terms in a single source, highlighted through their bolding in a snippet, is a strong indicator of relevance for the student. The attention-demanding nature of bolded words in snippets is evident in Karen's description of them as 'catchers' and 'eye-grabbers'. Edward noticed the bolded terms before identifying the audience of the site referred to above as doctors, psychiatrists and psychologists.

Charlotte acknowledged that occasionally the snippet was not a strong indicator of relevance to her needs: 'sometimes that little summary can be from a different part of the page' (Interview, Study 2). Even though the website dealt with her topic of interest, the snippet may not have been extracted from the part of the website that gave her the level of detail she required, and would thus not be immediately identifiable as being of high relevance. Charlotte indicated that she had formerly relied on titles of websites but had more recently trained herself to read the snippets. This suggests her belief that snippets are a more reliable way of judging the potential relevance of a source. Several students shared her belief. Paul, however, looked at the title to check if it matched his search before reading the extract. He appeared to

be focused on finding a *Wikipedia* article, which he would have been able to identify from the title (because it would typically end in 'Wikipedia, the free encyclopedia'), as opposed to giving his attention to the extract.

Another guide to the relevance of an item was the density of highlighted search terms in the snippets, or extracts, from individual websites that appear under each title in the list of results. This was taken as an indicator of whether the required information was scattered, or not, in the full document. While dealing with the individual source, relevance was also tested by searching for the occurrence of keywords, for example, by using the Find function in the Internet browser (which I use synonymously with 'Web browser'). The following extract (Karen, Interview, Study 3) provides an example of dependence on the density of keywords in snippets:

> Sometimes the words are pretty, like they just have like a 'Rome' over here and a 'dependence' over there and […] and I just, I don't go to them, I go to the ones where the words are like what I want and they're all close together kind of thing […] like it's actually more of a quote than just a bunch of words.

The converse of the 'close together' bolded words is a situation in which terms in bold are scattered throughout the extract. As expected, the latter situation dissuades the student from considering the item; Chloe, for example, referred to 'full-blown like gaps' between words in bold, which she did not like because 'it makes me think how much actual writing is in that website', and caused her concern that the source's information would be scattered: 'could be like a bit here, a bit there, a bit there'. The collocation of search terms in the snippets is used as a criterion in judgements of a source's relevance.

Google-provided snippets were important data for students in their pre-access judgements of relevance. Participants generally assessed the density of search terms from their search strings, assisted by their bolding, in order to gauge relevance from the collocation of the terms. While it seems oddly circular, if not distrustful of the search engine, to enter search terms and then look for them, participants appeared to want to judge for themselves whether the results suited their purposes. For additional illustrations of the role played by snippets in students' relevance judgements, see Appendix 4.10.

4.2.1.3 Title and URL

While participants in this study generally used snippets to gauge relevance before accessing any individual source, two other sources of metadata were also identified: titles of websites and URLs. Even though Karen was attracted to words in bold in the website extracts in her search results, she appeared to give precedence to titles when judging what sources were relevant: 'If that like exactly matches or pretty closely matches, then I just go straight to that [...] if the title, like the blue thing, matches what I've typed in, then I just go to it' (Interview, Study 3). Paul apparently gave a higher weighting to titles of sources than he did to snippets, as indicated above, although this is explained by his focus on locating a *Wikipedia* article to provide an introduction to his topic. The appearance of the name of the scientist in the title of an article in a source offering biographies was a strong drawcard for Mary-Ann.

Paul looked for a site whose URL used the name of the subject of his search, Beethoven; when he found that Beethoven.com was blocked by the school's Internet filtering system, he modified his search to the composer's full name and was satisfied with lvbeethoven.com, which he decided was both relevant and sufficiently reliable to use. 'Quite certain that a composer like him would have his own page', Paul referred to his search as being for 'Beethoven's site', apparently unaware that it was an accident of history which website's URL containing 'Beethoven' had been registered first. The URL also provided a clue to the relevance of a site for Sophie. She was looking for a discussion of the reasons for shortlisting *The Reluctant Fundamentalist* by Mohsen Hamid for the 2007 Man Booker Prize. The word 'forum' in a URL gave her a clue that 'you'd have people talking about it', and she selected that site after having rejected one above it, which, though also on the Man Booker site, she considered would have offered plot details, with which she was already familiar.

When examining the metadata provided by search results, students paid most attention to snippets but occasionally examined titles and URLs. If prior knowledge is considered to be metadata, then, used as the basis for the rejection of a site because it offers what a student already knows (as was the case for Sophie), that prior knowledge may be considered a factor in the student's decision making process.

4.2.2 Pre-access relevance criteria: Subjective clues

The relevance criteria used by participants discussed above may be grouped under the heading 'Pre-access relevance judgements' to identify them as judgements made about a source before beginning an examination of the actual source itself. Included in this group of pre-access relevance judgements is another set, which appears to lead to a more peremptory dismissal of sources from further consideration than in the case of the types of judgements reported above, if those sources do not meet participants' criteria. (Although I have used 'pre-access' to distinguish this set of judgements, it is not always clear at which points the rejection has occurred; occasionally, the source is accessed very briefly before the participant notices that it does not meet certain criteria.) Pre-access judgements in this second set lead, predominantly, to the rejection of the information source and include judgements about comprehensibility, completeness, whether access to the item is free or not, usefulness of video sources, and whether the source offers opinions or facts.

4.2.2.1 Comprehensibility

When a source was written at a level unsuitable for the student, or in a language that he or she did not understand, the item was rejected.

Amber (Interview, Study 2) spoke of preferring 'information that I can use and that I can understand'. Kelvin found *Wikipedia* articles to be 'usually written in language I can understand' (Journal, Study 1). Paul rejected an item in favour of another that was 'slightly more simpler' (Paul2, Interview, Study 3). Richard excluded information that was not easy to comprehend: 'if it was very cluttered and a bit over my head, then I sort of went away from that to a more, to information that I could understand'. He added, demonstrating awareness that his comprehension was necessary to his processing of information: 'if I can understand it, I can interpret it a bit more'. Sharon and Paul, both ignored a source in French, being unfamiliar with the language.

A high level of detail occasionally made a source inaccessible, especially if that property made it difficult for the participant to determine whether the source covered his or her selected focus. The following example of this relates to printed books, rather than to websites, which are the sources most commonly referred to in this report: 'some of them were too

detailed and like focusing on other stuff, like, say, just social, and was like massively thick'; and 'it was a bit hard to work out what to use and what not to, so I just like ditched books like that' (Rachel, Interview, Study 2).

Participants judged sources, either on the basis of metadata, or on the complete source, for their comprehensibility. Although I have categorised comprehensibility as a factor that is considered during a pre-access judgement of relevance, I acknowledge that such a criterion may also be applied during a post-access judgement, that is, once the participant has accessed the source. I suggest, however, that decisions about the comprehensibility of an item are beginning to be made before access, based on the metadata provided in a list of search results, notably the snippets, but sometimes also the title or URL. The connection of comprehensibility with post-access judgements of relevance is shown by a dotted line in Figure 4.1, which shows a similar connection with completeness, price, and fact or opinion (all of which are described below); the dotted line indicates the likelihood that this set of factors straddles pre-access and post-access judgements.

4.2.2.2 Completeness

When a source was incomplete (such as an abstract of an article, or an extract from a book), or was about a source, rather than the source itself (such as a review of a book), participants, with one exception, did not attempt to obtain the full source.

About to access a website concerning Churchill and Australia, Chloe realised that the source was a review of a book on that subject and aborted her attempt to visit that site. Some students passed over *Google Books* results on the basis that they offered incomplete sources: 'it's either going to mean I've got to buy it or I'm not really going to be able to view much of it' (Sharon, Interview, Study 3). In this extract, not only is the incompleteness a detractor but also the possibility that the item would need to be purchased, which is a factor considered below. The only student not averse to using *Google Books* was Sophie, whose needs, and personal skills and experience, were different: 'I've actually been using *Google Books* a lot because, for History, because they have the books on and they have the introductions and quite a lot of the actual content' (Interview, Study 3). Sophie found the facility of keyword searching within a book on *Google Books* attractive and, when she wanted to find the

complete source, went to a library that appeared to hold most of the items that she wanted.

Students generally considered what they were able to identify as full sources to be worth testing for relevance to their needs. They were reluctant to risk using a source that was incomplete or, as considered below, that required purchase.

4.2.2.3 Price

The essential question implicit when participants applied the price criterion was, 'Is the information free or not?' Free sources were favoured universally over ones that required payment, as when paying for a book or a subscription to a journal.

Information offered on a commercial site such as eBay or Amazon was routinely rejected: 'Ah, Amazon, I don't want to have to, I can't buy a book' (Chloe, Think-Aloud, Study 3). When Mary-Ann came across a reference on the www.iop.org site to 'The Physics Plus Project', a journal article requiring subscription to access, her response was, 'It looked like you had to download some text, it's like "No, I'll just go back to what I can find" ' (Interview, Study 3). The convenience of access to 'what I can find', or 'what I can get my hands on right now', is alluring, and leads to the completion of the task in a shorter time. Later, the need to pay for information led, again, to Mary-Ann's filtering out of the search result: ' "buy the truth", it sounds like I have to spend money or something or buy a book' (Interview, Study 3). Gerard persisted in searching, in an attempt to find a free copy, when unable to find a needed item: 'I was looking for the environmental impact statement and I don't really want to pay $25 for it, so I guess that's why I'm not finding it easily' (Think-Aloud, Study 3).

Not only did the participants appear to be accustomed to finding sufficient free resources on the Internet to complete their assignments, it is unlikely that they could afford to purchase an information source, considering both their time (if the item was not immediately downloadable and they had to wait for delivery or confirmation of receipt of payment) and their financial limits.

4.2.2.4 Utility of video sources

Two participants excluded video sources from consideration, citing the extra time that was needed to extract information from them when compared to written material. Another two, however, had specific needs for video material.

In line with what I have observed informally over almost twenty years, students were reluctant to use video sources in the preparation of their assignments. They perceived the information in video sources to be too time-consuming to process. Stefano used a clear rule to reject such material: 'I don't use videos'. He said, 'Generally I just tend to skip videos', preferring sources that were 'just written down' because 'it's just harder to analyse [videos] and, if I'm doing an assignment, I just want what's basic, given to me in plain English' (Interview, Study 3). Stefano refined his rule not to use videos, adding that he did not use them if they were not recordings of incidents; with the benefit of hindsight, he concluded that his topic, the Falklands War, would have lent itself to the use of video material, as recordings of actual events were available. It was clear, however, that he preferred his sources to offer written text.

When Chloe saw video material in her search results, she decided, 'I'll watch them later, because they might take up some time' (Think-Aloud, Study 3). I speculate, however, that her concern about their time-consuming nature overrode her intention to return to the videos. She appeared to find sufficient other material to meet the requirements of her topic.

The topics of some students were such that video material was more suitable for their purposes. Mary-Ann, who was investigating the physics of greenhouses, found videos, along with diagrams, to be more appropriate than explanations in written words: '*YouTube* videos and things, they're good as well, 'cause that way you get a sort of visual stuff'; and 'if there are pictures, they're good to look at too, like there's the diagram of a hotbox, which is an early model greenhouse, and that sort of helps get your head around concepts and how it would look and things, makes it easier to understand' (Think-Aloud, Study 3). Of course, where the subject matter being investigated was in the format of a video, such as Lara's comparison of *Grease* and *High School Musical*, each video was a primary source. Another topic that lent itself well to being supported by visual material, although not specifically moving images, was Gerard's; he was looking for a map to show the location of a mine for his Geography assignment.

While some students routinely dismissed video material from consideration for their tasks, for others, the format of moving images, or visual material in the form of diagrams, suited the topics they were investigating. Routine dismissal was based on the perception that the information in word-based texts was more readily processed, and so, where those were available, and appropriate to the task, they were preferred.

4.2.2.5 Fact or opinion

Participants differentiated between tasks that required factual and opinionative information. This distinction gave rise to implications for both gathering information and the presentation of their information in an end product, such as the student's essay or oral presentation. It was important to participants that they distinguished between fact and opinion to judge the relevance of information to their needs. This is an area where there is considerable overlap with reliability because of the trust, or lack of trust, in opinions (also considered in Section 4.3). The focus on gathering facts, especially 'basic facts', also overlaps with students' development of an overview of a topic area.

Lily distinguished between two types of information: fact and opinion. Her task required opinion and she appeared to consider facts irrelevant to her task: 'it's not something that we researched as a definite fact, […] so it didn't really have to be … factual. … It's more opinions and stuff, so we looked at lots, a number of different sites, um, to see all the different like opinions' (Interview, Study 1). An Internet search for information comparing *Grease* and *High School Musical* was daunting for Lara, who wrote, 'I was reluctant to go onto the internet to look for information since there I often find more information than I want and it is hard to pick out the needed information' (Journal, Study 1). Hints of information overload are evident, with its attendant difficulty of filtering information, presumably using both relevance and reliability criteria for the filtering process.

Gerard showed a distrust of opinion when looking for an analysis of issues surrounding the future of mining in a region, suggesting that he was attempting to find the objective facts of the matter, perhaps before formulating his own opinion on the issue: 'people's opinions on analysis stuff generally aren't very good' (Interview, Study 3); and 'this just looks like different people's opinions so that's not really useful so I don't really need to look into that' (Think-Aloud, Study 3). There was some acknowledgement by participants that opinions

could be held about factual events; one such example comes from David, who was examining the relationship of Work Choices, Australia's workplace relations legislation, and the so-called war on the waterfront: 'a topic which most people know of or have heard of and have an opinion of [*edited for clarity*]'; and 'with such a large topic, well known topic, it was hard to determine fact from fiction' (Journal, Study 1). Participants appear to have held a mental model in which facts were more important than either opinions or fiction; this reflects the nature of their selected topics, and does suggest that the students paid less attention to opinions about the matters they were investigating, say, historical events, than what they thought of as facts.

Most students demonstrated a focus on facts. Charlotte focused on 'getting all your facts right'. Mark aimed to gather the 'basic facts' about his topic. Michael opened a Word document to 'do the facts in there'. Richard put together 'a bit of a fact sheet'. (Foregoing data extracts are from interviews in Study 2.) Their focus on fact gathering was maintained even though most of their topics required that they adopt a viewpoint, which needed to be supported by facts. This may suggest that these students were often at a knowledge-building stage and had not yet developed a perspective.

Karen was one of few participants who showed an understanding of the conventions of an academic subject like History when she said, 'In History, I guess you really have to have, like a, your own little point of view' (Interview, Study 3). This is an implicit acknowledgement that even though historical facts may be gathered, the student's perspective on those facts must form part of the focus they adopt in their final information product, commonly an essay or oral presentation to the class. Opinions towards such facts reflect the students' focus but there was rarely an attempt to gather opinions when the student perceived the task to be essentially fact gathering.

It was appropriate for Sophie to gather opinions, as her task was to develop criteria for judging the literary merit of Mohsin Hamid's *The Reluctant Fundamentalist*. She considered the Man Booker Prize website to offer the most relevant and reliable information to stimulate her thinking about what criteria to develop. Lionel's task was to prepare an oral presentation analyzing Franz Kafka's *The Trial*; like Sophie, he searched for quotations that offered opinions about a selected text.

Within opinionative information there are two categories: opinions that can be trusted, and are presented by those with some credibility in the area; and opinions offered by the general public, and which are opinions on trivial matters: 'some of them are just like kind of stupid chat rooms that say like [*spoken in a higher pitch*] "I like Harry Potter better because of this" or "I like *Lord of the Rings* better because Legolas is hot" and we were like, yeah, well, we didn't really use that obviously because it's not relevant'. Lily later elaborated on whose opinions she considered to be valid: 'actually intelligent people talking about, um, you know, like, say, book or movie reviewers actually saying intelligent things' (Lily, Interview, Study 1).

While most of the information tasks undertaken by participants in the study required the finding of facts relevant to their topics, some tasks called for the gathering of opinions on a chosen topic. Participants were careful to distinguish between facts and opinions in their judgements of the relevance of information; when opinions were appropriate to their task, they distinguished between opinions from laypersons expressed informally and the opinions of those whom they considered to have qualifications in the area.

4.2.3 Post-access relevance criteria

I presented above results that I categorised as pre-access judgements of relevance, a category of relevance judgements made before an individual source is accessed. In this section I will consider post-access judgements of relevance, by which I mean those made after the participant has accessed the information source. Post-access judgements are characterised by a participant's desire to locate an overview of his or her chosen topic; to connect one piece of relevant information with another; to identify sources whose authors have treated the topic under consideration in sufficient depth; and to examine the structure of the source, particularly its topic sentences, first paragraph and headings.

4.2.3.1 Topic overview, or relevance priming

The need to locate an introduction to a topic area was explicit in the data of 30 of the 37 participants. Perhaps this is not surprising, given most students' lack of background knowledge; after all, the intention of the information search task is to develop knowledge. Sources that offered an overview were accorded a high degree of relevance and became critical in what participants perceived to be relevant in subsequent sources. The majority of students found *Wikipedia* articles provided the introduction they needed.

Participants typically tuned in to information that offered an overview, thus considering such information to have prime relevance, as seen in the following data extracts: ‘usually I just go for the basics first, so I’ll get a basic outline of what I’m trying to find out and then I’ll just build on it after a few researching sessions’ (Mary-Ann, Think-Aloud, Study 3); and ‘I’d type “beginning of surrealism” and see if the Web page I clicked had a good overview of that’ (Emily, Interview, Study 2). Mia (Journal, Study 1) demonstrated the importance of grasping introductory information before confronting more detailed information when she:

> decided to research online sources on the witch trials in order to grasp a better basic understanding of the trials before reading the book in detail - so as to understand the circumstances on a whole before going into detail about them (as the book does).

When sources did not offer such an overview, they were rejected as irrelevant: Jenny (Interview, Study 1) found journal articles from a database to which a university subscribed were ‘not really giving a very broad range of information so I didn’t find that quite as helpful’.

Brian’s routine was to enter his search in *Google* ‘and then go to the *Wikipedia* page and that would give me an overview of what it’s all about’. A to-and-fro movement from *Wikipedia* article to subsequent *Google* search was evident when Brian began to develop a focus as a result of his reading of the *Wikipedia* article: ‘if I’m looking for something specific, I go back to *Google* and search for that’ (Interview, Study 1). Occasionally, the movement was linear, namely from *Wikipedia* to other sources, rather than the recursive movement seen in the case of Brian; when Rachel was preparing an essay on why the United States of America dropped atomic bombs on Hiroshima and Nagasaki, she used a *Wikipedia* article ‘just to see like what happened and really understand it, so I’d know like what information to look for’ (Interview, Study 2). What the student reads in an overview source sensitises him or her to what to focus on in later sources, thus giving him or her a basis for making a relevance judgement. (This point is pursued further in Section 4.2.3.2.)

Other students shared Brian's habit of finding an overview in a *Wikipedia* article; see Table 4.1 for a selection of data extracts.

Participant	***Extract***	***Data type***	***Study***
Chloe	'I generally start with *Wiki*, just if, I don't know, just to give me a general idea'	Interview	3
Chloe	*'Wikipedia*, good place to start'	Think-Aloud	3
David	'Wikipedia gave me good background information about both the topics'	Journal	1
Edward	'It's [*Wikipedia*'s] just a starting reference point for me'	Interview	3
Emily	'I always use it [*Wikipedia*] to get a summary of the things'	Interview	2
Jenny	'*Wikipedia* […] I just go to for a general overview'	Interview	1
Lionel	'I would tend to use a *Wikipedia* article, not as the only source but as something you can refer to and you can get a grounding knowledge in'	Interview	3
Mark	'I just get a base knowledge from *Wikipedia* […] it just starts me off, 'cause it always has like the start of everything'	Interview	2
Paul	'Let's have a look at *Wikipedia* to get just a general idea' '*Wikipedia*'s useful in terms of, um, concepts or topics which you have absolutely no idea, you just need a brief introduction to it'	Interview	3

Table 4.1: Data extracts illustrating participants' use of *Wikipedia* to find an overview

Kelvin wrote in his journal about the problems he faced when unable to locate a *Wikipedia* article, pointing to the role that *Wikipedia* plays in the process of filtering information: 'if there is no wikipedia article on a certain topic then it is sometimes hard to find enough information, as a lot of the results given by a google search need close filtering to find any worthwhile information' (Study 1). (Kelvin's experience of filtering to find relevant information closely parallels Lara's, which was described above.) I suggest that a topic overview, more often than not provided by *Wikipedia* for the participants in the current study, has a critical role in assisting the student to cope with information overload by narrowing the field of interest to a convenient summary. A topic overview, then, assists the student to make relevance judgements because it assists him or her to see what is relevant in sources accessed in the stage following the development of an overview.

Some students offered instances in which *Wikipedia* was not used as the prime source. Amber (Interview, Study 2) referred to 'the main book to start with, it's the most helpful' and said the following about her single, convenient book source:

> That one was really good because it has information in general on everything but also it has like specific sort of case studies of particular women in history that were influential in the establishment of the colony.

Elizabeth found an article about the moral dilemmas that countries have had over the years about their participation in the Olympic Games when the host country has committed an act that has led to international disapproval: 'in the article like it had all the controversial issues so I could draw the comparisons' (Interview, Study 2). In the same way that Elizabeth found the article useful for drawing together the main issues, Gerard found that news sites offered pertinent summaries of the controversies surrounding the development of a mine in a particular region: 'they generally sum it up pretty well' (Interview, Study 3); and 'it just looks like a news site so it might have like the whole picture of how it's, how it is …' (Think-Aloud, Study 3). Kristian (Interview, Study 2) found a single source that would have provided him with the most convenient introduction, but he came across it only after he had explored the other sources and developed his own overview:

> I went through all these other websites and collected little bits of information and it just kind of frustrated me a bit because then I found this one website that had all of it … it was like a *big* website just about the gold rush and I was kind of upset that I went through all the other ones and gathered little bits when I could've just gone to one, but then I suppose I did cross-reference, which is good.

Kristian noted the advantage of having consulted a variety of sources, confirming this with 'I know that the information is on different sites as well so it's not like one person making a joke or something'. In another example of a participant not depending on a *Wikipedia* article for an overview, Victoria (Interview, Study 3) used the online edition of *Encyclopaedia Britannica* for a 'general overview' of Joseph McCarthy, when examining McCarthyism in America: 'it was sort of like a nice little summary sort of thing, how he started and what happened'. Victoria used *Wikipedia* in addition to *Britannica*, commenting on the former

source that, ‘Usually it gives you a pretty good general idea of what to look for’, again underlining the important role played by the prime source in sensitising the participant to information in a subsequent source.

The source from which an overview is gained becomes the prime source, as well as the priming source, in that it primes the reader to notice information in subsequent sources that corresponds with information in that prime source. The prime source offers a framework for the development of subsequent knowledge. While most students used *Wikipedia* as the source of their overview information, there were some exceptions in which students found other sources provided the introduction to topics that they needed. There appears to be a strong drive for such information; *Wikipedia* offers the most convenient and readily understood primary source for students, despite their perceptions that teachers disapprove of its use (a point that will be considered further in Section 4.3.1.2 and discussed in Section 5.2).

4.2.3.2 Chaining

After participants had developed an introductory understanding of their topic, they proceeded to explore sources that related to their primary source. The primary source acted as a launching pad to further resources, with participants considering any correspondence between information in the primary source and subsequent sources as having both a bolstering effect on the information in the primary source and lending credibility to the information in any subsequent sources. *Chaining* seems to be a fitting way to describe this phenomenon, given both the linking of sources and the reciprocal strengthening effect they had on each other. The observation of a piece of information in a second source that was recognised as having been seen in the first source reinforced the perception that that piece of information was relevant; the consolidation of the perception was aided by an earlier perception that such a piece of information, having been gleaned from an overview source, must encompass a central aspect of the topic.

Seventeen participants engaged in relevance chaining, thus making strong connections with prior knowledge. Relevance chaining formed a critical part of the action of building on a primary source. Once an overview had been developed, the student was then able to find information in subsequent sources that was consistent with what was found in the source that provided the overview: ‘It’s easier to go to something main and then branch out, kind of

thing' (Sharon, Interview, Study 3). The role of a primary source in sensitising participants to relevance in subsequent sources was elaborated in Section 4.2.3.1.

Chaining occurred when the results of one search led to another search that built upon the original one. The most striking example came from Mary-Ann: 'it was talking about how he cooked a stew in a hot box as well and it was all cooked well and everything … and you take that bit of information and, um, yeah, you see how, what that can lead to' (Interview, Study 3); and the following from her think-aloud report (Study 3):

> Once you have a good site, sometimes you'll take a piece of information from it, and search it from that, so like the physicist, so maybe I'll search him from that first site that gave me the information on him. […] What I'd next do is just have a read through, see what else I can find and then search from that new information.

Decisions about relevance have a 'snowballing' effect in that once a particular topic or subtopic is focused upon by the student, and that focus then narrows down the set of information that has the potential to be perceived by the student to be relevant, the chosen focus area will influence what is noted in subsequent information. Mary-Ann (Interview, Study 3) spoke of the 'on-flow effect', in which one piece of relevant information leads to another piece of relevant information. Knowledge building is very clear when this happens; Mary-Ann described 'trying to find out something from something else', a strategy in which 'you take that bit of information and … see… what that can lead to'. An element of information discovery is also evident here. The strategy has much in common with using an overview of a topic; both the overview and the subsequently found bits of information form part of a chain of linked information, with each piece of information predisposing the student to notice another piece in any subsequent information considered. The latter piece of information becomes related to the former piece. The devotion of attention to selected pieces of salient information is critical in knowledge building.

Another example of chaining behaviour was seen when Edward, searching for the consequences of erratic behaviour, found, from an earlier search, a newspaper article reporting that, as a child, one of the murderers he was investigating, had displayed erratic behaviour. When one source referred to an environmental impact statement, Gerard embarked on a new search to find a copy online.

Gerard was the only participant to demonstrate what I call ‘backward chaining’. While all other participants moved forward in a linear fashion from one source to another in their chaining behaviour, Gerard moved backward in an attempt to find the primary source on which a newspaper article was based. To describe this action, he used imagery evocative of an explorer tracing the source of a river: ‘if I could find where they’d sourced that from then I’d have like a bigger, like following the stream back up to the source’ (Interview, Study 3).

Participants commonly used information from the *Wikipedia* article that offered an overview as the basis of a search in *Google*. This to-and-fro movement between *Wikipedia* and *Google* searching (after a *Wikipedia* article had been found in an initial *Google* search) was noted in Brian’s data above. The practice was also noted in David and Emily’s, respectively: ‘Information from Wikipedia was used to assist my searching on google’ (Journal, Study 1); and ‘I use it [*Wikipedia*] to get an overview of the topic and then I go into *Google* and search for whichever bit I’m interested in’ (Interview, Study 2).

At least three participants used the links in *Wikipedia* articles in their chaining activity. *Wikipedia* articles typically present hyperlinks to referenced sources and David, Richard, and Sophie found these useful in the building of their knowledge. In addition to providing a basis for his comparative argument, a *Wikipedia* article gave David ‘links to other relevant sites’ (Journal, Study 1). Richard not only found relevant sites but ones that he perceived were coincidentally reliable when he decided that he would ‘just research what really Anzac Day is all about and the Gallipoli campaign so went to *Wikipedia*, had a look through there to the external links and where they got their, what they referenced’ (Interview, Study 2). When Sophie saw a reference to a book in a *Wikipedia* article, she planned to search for it in a library that she knew was likely to hold a copy. It appears that participants judged the references of *Wikipedia* articles to be highly likely to be relevant to their needs and so considered them worthwhile pursuing.

Chaining, in effect, displays the efficient use of prior knowledge. Such prior knowledge is likely in the participant’s short-term memory, as would occur in relation to a chunk of information seen a short time before the search for the linking chunk of information takes place; or the prior knowledge is in the participant’s long-term memory, as in the case of a piece of information recalled from a less recent experience.

4.2.3.3 Depth of topic treatment

Participants considered the depth with which authors treated topics as a factor in deciding the relevance of a source to their needs. Whereas at an early point in their information search process (ISP), their need was for an overview of a topic area, at a later stage, they were looking for more detailed treatments of their selected area of investigation.

Printed books offered several participants the in-depth treatment they were seeking. Once Chloe had learned from one set of printed books about Matthew Flinders' voyages related to Australia, she found another book and considered it to be the most useful single book for providing additional detail in the form of Flinders' other voyages, such as the one to Tahiti. Chloe noted that the additional detail would offer a better experience for a reader of her essay: 'having more information in it, sort of, like, will make it a bit more engaging' (Interview, Study 2). Printed books were Elizabeth's favoured source of information on the Olympics because 'they just went through it more thoroughly' (Interview, Study 2). Like Chloe and Elizabeth, Sophie favoured printed books for their depth of topic treatment: 'they had the most information in them'. Victoria (Interview, Study 2) also referred to two printed books that were the most useful sources for her: 'I had a thin book of a general outline of Roosevelt's career and that sort of thing'; and 'I also had a book of speeches and outlines of laws he'd passed'. The factors that made these two sources particularly useful to her were: 'It gave me the main points that I needed and I could go to the other book and see the specific points that I wanted, so details of the Tenancy Act, or whatever it was'. There is some indication here that online sources, particularly free websites, sometimes do not offer sufficient detail for the needs of the student, and that printed books meet those needs.

When Jenny gained access to online journal articles, she found that their in-depth treatment did not suit the stage of the ISP at which she was. Although she found that 'they're mainly written for a specific purpose, like they are like specifically to answer one set question', she did acknowledge that such articles do 'give you bit of a deeper perspective' (Interview, Study 1). Depth of treatment was a detractor for Jenny, who was, at that point, searching for an overview. It is unlikely that she went back to these sources after the development of an overview, particularly because she found them 'a little bit challenging sometimes'.

Another student found sources that assumed a level of prior knowledge that he did not have: ‘some of the other sites, um, usually explain in, you know, quite some depth with assumed knowledge and that’s not for me’ (Paul2, Interview, Study 3).

While neither Jenny nor Paul were likely to need the in-depth resources that they found, and so considered them irrelevant to their needs, Stefano offers an example of a student who was looking for sources that met his criterion for depth of treatment in what may described as relevance chaining, which is discussed above. The effect was his active avoidance of sources offering an introduction to his Falklands War topic:

> It just seems too brief, like, I just, it’s good to have something with more detail. It’s just a waste, I find it’s a bit of a waste of space having it brief, ’cause then you could go through the bibliography and […] it does take time, so I’m saying, if I could, that information is somewhere else, um, very basically an introduction, I don’t need that website, so I can skip straight past it and if it perha-, perchance it does have something that’s useful, that I’m missing out on, I can always go back and get it. (Interview, Study 3)

When a source did not treat an aspect of the topic in the depth desired by the participant, one of two reactions was observed: the participant broadened his or her search; or the participant did not include that aspect of the topic in his or her final product. When Michael was unable to locate information on the Melbourne suburb of St Kilda in the 1920s, he turned his attention to Melbourne generally. Michael found that there was simultaneously a lack of information on what he called a ‘small topic’, and that the information on the Melbourne of that period did not offer sufficient detail about a particular suburb; his solution was as follows: ‘with the St Kilda information I kind of just generalised it, as in comparison to Melbourne, a small suburb of Melbourne’ (Interview, Study 1). Mark, exploring the so-called Bodyline incident in a cricket match between Australia and England in the Ashes tour in the 1930s, had heard from his teacher that the English were hypocritical for criticising the Australians when they had employed a similar tactic, attempted to focus on that aspect in his search, but was unsuccessful and so abandoned the aspect: ‘I looked it up and I tried looking for it everywhere but I couldn’t find any so I just, like, stopped that paragraph. […] And then I found, like, a tiny little bit on it but it wasn’t enough to like start a paragraph’ (Mark, Interview, Study 2).

Participants considered the depth of the information in sources and varied in their needs, on the one hand, for general information (as discussed in Section 4.2.3.1), and, on the other hand, for specific, focused, in-depth information. Their need for either the former or the latter type of information influenced whether they judged the information in each source to be relevant or not. Whether they were searching for a prime source, or a source that could be linked, chain-like, to the prime source, dictated what sources participants accorded relevance. Depth of topic treatment has been discussed above as a criterion associated with relevance judgements; in Section 4.3, this criterion is treated as a judgement of reliability. While there is an overlap, there are also some distinctions between usages of the criterion.

4.2.3.4 Structural clues

Participants used the structure of the writing in information sources to judge relevance, focusing particularly on topic sentences in paragraphs, the first paragraph in a source, and the headings of a source. Participants sought topicality in such structural clues.

Victoria was the only participant who referred to the use of topic sentences as an aid to her assessment of whether a source was relevant. Her technique was 'sort of scan-reading like the first sentence of each sort of paragraph and if it was, appeared that it would be helpful, I continued reading the paragraph and stuff' (Interview, Study 3). Other participants focused their attention on the introductory paragraph of a source to help them decide its relevance. Table 4.2 offers a selection of data extracts that illustrate their technique.

Participant	***Extract***	***Data type***	***Study***
Mark	'I just read the introduction paragraph about what they said and then like, if they're on the right track, then I go on with that but if they're not, I just close it and go to another one'	Interview	2
Mary-Ann	'You sort of read the first paragraph and see if you should follow it from there'; and 'It's like the first paragraph, sort of sums it up, […] so when reading the first paragraph you sort of get a bit of an overview and so, if your questions are answered in the first paragraph, then you don't really need to, but otherwise you skim through the rest of it and see if there's anything else in there'	Interview	3
Sophie	[*Referring to Google Books*] 'You get a really good idea if you just read like the intr-, 'cause they normally have the introductions at least, and that gives you an idea of what the book, and if you really want to go and, um, look up the book at the [name of library A] or the, um, [name of library B], then you can, and at least you've had a look at it beforehand and that you know that it's worth going to [consult]'	Think-Aloud	3

Table 4.2: Participants' use of introductory paragraphs or introductions to determine relevance

The ultimate data extract in Table 4.2 offers an interesting example of the stimulation of usage of hard copy books in libraries through the placing of extracts of books on the Internet. Sophie used the online versions of the books as a selection aid, and her examination of the item in digital format gave her data to use in a decision about whether the full item was likely to be relevant enough to obtain.

Information structure aided a student's comprehension of information and unsuitably structured information was likely to be rejected. Sharon found it difficult to 'like, extract the data sort of thing' when presented with 'just, like, slabs and slabs of writing'; she preferred information 'if it's dot points at least or, um, paragraphs that are set aside for each topic', saying that 'It's just a bit harder to read when it's, um, just blocks and you have to, like, pick it out' (Interview, Study 3). Mary-Ann (Interview, Study 3) spoke of 'sort of scanning through the headings' of a source to find what was relevant. Kristian found a single website most convenient because 'it had subheadings like impacts of gold mining boom, social, economic, cultural, […] exactly what I needed' (Interview, Study 2). When reading an article on the history of Pakistan, Sophie (Interview, Study 3) was able to scan to the heading of the era relevant to her search for information about life in the country in 2007, the third military era (1999-2007). When an information source was considered individually, the headings within that information source were an important influence on relevance judgements. The arrangement of information under headings made for easier reading, facilitating the scanning of the structured information for relevance to the information seeker.

Allied to the use of headings is the use of another device for organising information and indicating its structure to the reader: a panel, or text box, that outlines an encyclopaedia article. Chloe found a *Wikipedia* article's employment of such a device was helpful for providing 'sort of like a quick overview of everything, like, in […] it' (Interview, Study 3).

Students used structural aspects of information both reactively and proactively to assist their relevance judgements. Students both looked for structural aspects in others' writing (reactive) and sought to include such aspects in their own writing (proactive). Such behaviour suggests an appreciation of the conventions of writing, and indicates that participants were competent

both in the decoding of others' writing and in the encoding of their own writing. Stefano, for example, used the scaffolding of headings while gathering information, which he justified as follows:

> … so I just don't get confused, 'cause sometimes if you don't put headings in, write stuff down, you come back to it at a later stage and you say, 'Ah, what's this relate to? Why is that there?' […] Normally, just go through, put headings for everything and then once the assignment's done, everything fits in well, just get rid of the headings (Interview, Study 3).

Kathy was another student who, anticipating the need for structure in her final information product, used headings; she used a two-column table to compare Paris Hilton and Marilyn Monroe, with rows to indicate features against which she compared the two personalities. Her labels for the features indicated the topic for each paragraph.

Where headings were lacking, or sparse, or were not descriptive of the content in terms familiar to the student, sources were not considered any further. Highly relevant material could conceivably be poorly structured, or not organised at all; nevertheless, it would be rejected for not having met the requirement to be well organised.

Participants used the conventions of writing structure, such as headings, topic sentences in paragraphs, and introductions, or introductory paragraphs. They recognised these conventions as devices that could be used to gauge the relevance of an information source without having to read the entire item. Students showed clear signs of having been socialised into the employment of such devices through their adoption of them in their own writing. The proactive imposition of structure by students on their writing features clearly in the process of adding, which is elaborated in Section 4.4.5.3.

4.2.4 Conclusion to research question 1 (relevance decisions)

In answer to the question of how participants decided on the relevance of information, my study found two sets of relevance criteria: pre-access, employed before accessing the full source; and post-access, applied after the participant had accessed the full source. I found that pre-access judgements of relevance could be further subdivided into two subsets: clues to relevance provided by the information system; and clues to relevance that were more subjective, and so depended more on the set of skills and needs of the individual information seeker. Participants examined such clues provided by the information system as the first and other early results; extracts from the sources; titles; and URLs. More subjective relevance clues were the participant's ability to understand the material; whether the full source was provided or not; whether money was needed to purchase the item; and whether video sources were able to meet the information seeker's needs or not. Post-access judgements of relevance were characterised by a strong need to develop an overview of the topic, and were followed by the need to find information that could be linked with the information from the overview. Other post-access criteria included the depth to which the topic was treated and the structure of the information.

The use of topicality as a relevance criterion is discussed below in Section 5.6.2 under the heading of matching, which is considered part of the theme of knowledge building. In the next section, I turn to my second research question. Inevitably, there will be some overlap between students' judgements of relevance and their judgements of the reliability of information. Two such examples are: the phenomenon of participants comparing information with their prior knowledge, which may entail a simultaneous judgement of relevance and reliability; and the phenomenon of seeking information with sufficient depth, where it is difficult to draw a conceptual distinction between seeking such information for sufficiency (which is more of a relevance criterion) and seeking it because a more in-depth treatment is likely to be more reliable than a superficial treatment.

4.3 Research question 2: What reliability criteria do students employ?

As occurred in the case of relevance criteria, I observed two sets of reliability criteria, which I have called pre-access reliability criteria and post-access reliability criteria, to distinguish the point of application of each set (before and after, respectively, the participant has accessed the source of information). Pre-access criteria include participants' usage of the URL, and the reputation of the source, as guides to the reliability of information. Post-access criteria include the consistency of the information with the participant's prior knowledge, the graphic design of the source, the writing style employed, and the credentials of the authors. See Figure 4.2 for the reliability criteria observed in the current study.

Participants used various words and phrases to refer to reliability. Positive labels of reliability included 'reliable', 'credible', 'good', 'trustworthy', 'legitimate', 'decent', and 'true'. The 'word clouds' in Figures 4.5 and 4.6 show more frequently used words as larger than less frequently used ones and, respectively, show positive and negative references to reliability. Further examples are to be found in Appendix 4.11 and Appendix 4.12, which, respectively, show positive (reliable) and negative (not reliable) labels for reliability, and whose content was used to generate the word clouds.

Figure 4.5: 'Word cloud' of participants' positive references to reliability

Figure 4.6: 'Word cloud' of participants' negative references to reliability

Taylor (2012) asks whether the quality of Web resources was even a consideration of the generation born after 1982 whereas my study has assumed that information quality *is* evaluated by students. While my think-aloud and journal data provided evidence of spontaneous evaluative behaviour (for example, Appendices 4.3: A.2 and A.8; 4.5: A.9; 4.7: A.31; 4.11: Stefano; and 4.12: Daniel and Kathy), it is likely that, for several participants, information quality was not always a conscious consideration.

4.3.1 Pre-access reliability criteria

4.3.1.1 URLs

Whereas participants examined the URL for clues to the website's content, as discussed in Section 4.2.1.3, they also used the URL for clues to the website's reliability. Participants focused on the suffix of the URL (for example, '.com', '.org' and '.gov') in their reliability judgements. I have considered this behaviour as a pre-access judgement, assuming that this property of the URL was generally noticed before accessing the full information source; of course, the participant may have detected it during a visit to the website, but the data do not always provide evidence of when the participant observed the property.

One student combined what appeared to be depth of topic treatment and the origin of the information, as revealed in the URL's suffix, when he reported, 'There was just so much and it was a '.gov' site […] so that usually does mean that it is reliable' (Kristian, Interview, Study 2). Victoria demonstrated a similar trust in '.gov' websites; when asked how she dealt

with contradictory information, she replied, ' […] if it was two websites, I'd use the one that I deemed more reliable, whether it was like a government one or something like that' (Interview, Study 2).

Rachel recalled a list of URL endings supplied by a teacher the previous year that was used for shorthand ways of judging reliability:

> I can't remember quite what it was, but in, I think it was Year 9, I had [teacher's name] as a History teacher and he told us, you know, how some websites in '.edu', they're usually good, […] '.com' means you pay for it, so they're not usually as reliable […]. I know I've a whole list somewhere, and so, yeah, I try and focus on those websites more. (Interview, Study 2)

Sophie seemed to believe that a URL with the suffix '.org' conveyed reliability, although the presence of 'Lecture 14' in the snippet may have had a stronger influence on her judgement. After she said, 'It was historyguide.org, it was an organisation', I asked for confirmation of what appeared to be her trust in such URLs; her response showed some uncertainty: 'Maybe, I dunno, probably' (Interview, Study 3). Sophie had possibly either not consciously considered this property of the URL until I asked her, or she had been swayed more by the reference to the item being a lecture.

A similar uncertainty about the criteria she uses to assess reliability was seen in data from Elizabeth: 'I use, like, university sites and stuff, like proper History sites, I dunno, Olympics, um, yeah, just things that seem sort of credible, I guess, I dunno' [*seemed slightly awkward, embarrassed*] (Interview, Study 2). Later in the interview, she showed an awareness of '.edu' being associated with university websites.

In the following data extract, Chloe reacted with suspicion to a URL that contained several numbers and 's1942': 'I don't like numbers, random letters that don't mean anything, so I was a bit unsure about it' (Interview, Study 3). However, the suffix finally allayed her concern: 'weird-looking website but we'll go to it, it's got a dot org, I like dot orgs' (Think-Aloud, Study 3).

Edward saw 'smh' in a URL and recognised that the *Sydney Morning Herald* had been

involved in the creation of the information. Given his trust in that newspaper, that trust was transferred to the information he had before him. This example could equally be considered in Section 4.3.1.2, where I consider source reputation.

Elizabeth, explaining what she found appealing about 'proper History sites […] like www.history', said, 'I don't know what it is, like it has something in the name that makes it sound more professional' (Interview, Study 2). Although not entirely clear whether Mary-Ann was referring to a title or a URL, she selected the source with the 'smarter-sounding website name' (Think-Aloud, Study 3). Reliability judgements such as Elizabeth's and Mary-Ann's are far more subjective assessments than the identification of '.edu' or '.org' or '.gov' in a URL. They suggest that these two students have a set of criteria by which they judge professionalism and 'smartness'; my data shed little light on such criteria, beyond their reporting as subjective assessments.

Participants used the suffix of the URL as a guide to its reliability. They trusted websites whose URLs ended in '.edu', '.gov', and '.org', showing some distrust of those ending in '.com'. There was some indication that they applied rules of thumb that had been inculcated by teachers. The low level of references to URL suffixes in think-aloud reports suggests to me that participants were not always conscious of their application of the rule of thumb, and may have used this as a *post hoc* justification. Participants used the URL to determine the origin of the information, depending on such factors as the reputation of the source to provide reliable information and how sophisticated the URL sounded to them.

4.3.1.2 Source reputation

Both the reputation of the source as an individual source, and the reputation of the category to which a source belonged, influenced students' perceptions of the reliability of the information. The reputation of a source forms part of the set of personal beliefs brought by the information seeker to the task; such beliefs have accumulated over the academic life of the student, with results suggesting that they had been absorbed primarily from teachers, and parents. Underlining the difficulty of separating the concepts of relevance and reliability, the reputation of a source, though sometimes influencing participants to decide it was highly likely to offer relevant information, more often was used in a decision about the reliability of information.

While source reputation served as an aid to a decision about the relevance of a source, such as a belief that *Wikipedia* would offer relevant information, or trusting that *Spark Notes* would have a chapter-by-chapter summary of a piece of literature under consideration, participants were more likely to use source reputation as an indicator of reliability. Charlotte considered *Encyclopaedia Britannica* a more reliable source than *Wikipedia*. *Britannica* also had a sound reputation in the view of Emily and Victoria. Kathy's search for information on Paris Hilton did not include popular, mass market magazines: 'I believe they are not a reliable source' (Journal, Study 1). Examples of sources that participants regarded as trustworthy were: the *Sydney Morning Herald* (Edward); the British Broadcasting Corporation ('BBC, very, very reliable'; Stefano, Interview, Study 3); Geoscience Australia's website ('really, really reliable'; Gerard, Interview, Study 3); and an online database covering ancient and medieval history (Sharon). The extract below, from Gerard (Interview, Study 3), indicates the multi-factored nature of trust in a particular source, a book published by a geological society; trust here is related to the book's authorship, its objective treatment of the topic, its depth of detail, and its provision of references that can be used in relevance chaining:

> It's by the […] Geological Society, so they have a lot of, like, people contributing, so it's not very biased but it's got a lot of facts in it, which is good for this, um, I trust it, I do, and they have a very long reference list, which is also nice when you're looking for things; looking through their references is also very good, so I think that's a very trustable source.

Participants were more likely than not to hold the view that *Wikipedia* suffered from a lack of reliability, making comments such as those in Table 4.3.

Participant	***Extract***	***Data type***	***Study***
Daniel	'Not the most reliable'	Journal	1
Jenny	'Not necessarily that trustworthy […] not necessarily reliable'	Interview	1
Kelvin	'Apart from when I've seen friends, you know, putting little kind of stupid messages in there, it's been accurate every time I've used it'	Interview	1
Kelvin	'I have not yet found one mistake on *Wikipedia*'	Journal	1
Lionel	'It's really bad, it's, um, yeah, it's not written well' [referring to the *Wikipedia* entry for his selected piece of literature]	Interview	3
Mark	'Sometimes not the best'	Interview	2
Mary-Ann	'Anyone can change it'	Interview	3
Michael	'You don't obviously get too much positive things from that'	Interview	2
Ryan	'From past experience it has been pretty reliable, I know you can go into it and edit things and there's been stories about government agencies changing things and things like that'	Interview	1
Sharon	'I don't use it really as a credible source'	Interview	3
Sharon	'it's not that good a source, 'cause anyone can edit it, […] not all of it's trusted'	Think-Aloud	3
Stefano	'You don't know what you're getting, anyone can edit it, but, from what I've heard, I think it's only professors or something that can actually put in permanent stuff there […] most of the time it's pretty good and I've never, it's never failed me'	Interview	3
Victoria	'Not exactly reliable'	Interview	3

Table 4.3: Participants' views of *Wikipedia*'s reliability

Participants almost universally perceived *Wikipedia* as monolithic, showing little awareness, with the exception of Sharon, Stefano and Lionel, of the potential variation in reliability across disciplines represented, or across time, or within individual articles in the encyclopaedia. Lionel, for example, evaluated a specific article in *Wikipedia* (Appendix 4.3, A.30). Table 4.4 below presents data extracts to indicate that participants viewed *Wikipedia* as a single source, rather than singling out any subject areas in which the source has particular strengths, that is, *Wikipedia* was viewed generally when students made judgements about its reliability as a whole, or about its utility in providing general or introductory information about their topic areas. Despite participants' claims about the unreliability of *Wikipedia*, the online encyclopaedia has an assumed reliability for them. This assumed reliability was evident in the words Paul used in relation to a Physics assignment that 'wasn't worth anything', that is, it was not for assessment purposes: 'I'll pretend *Wikipedia*'s a credible source' (Interview, Study 3).

Participant	***Extract***	***Data type***	***Study***
Brian	'*Wikipedia* – good first overview'	Journal	1
Charlotte	'*Wikipedia* is always a bit shifty'	Interview	2
Chloe	'*Wikipedia*'s pretty basic'	Think-Aloud	3
Edward	'*Wikipedia* can be fairly reliable'	Interview	3
Jenny	'*Wikipedia* isn't necessarily reliable'	Interview	1
Karen	'I do like *Wikipedia'*	Interview	3
Ryan	'I guess *Wikipedia*'s always good'	Interview	1
Sharon	'I often go to *Wikipedia* first'	Interview	3
Sophie	'*Wikipedia* is pretty good most of the time'	Interview	2

Table 4.4: Data extracts illustrating participants' undifferentiated view of *Wikipedia*

Wikipedia was widely used (particularly in the building of an overview, as discussed in Section 4.2.3.1); however, the vast majority of participants considered it a source disapproved by their teachers. The reputation of *Wikipedia* among participants will be taken up in Section 4.4.1, which considers the influence of teachers on students' views, raising questions about the strength of students' convictions about the encyclopaedia, despite what the data extracts above appear to convey.

Some participants were of the opinion that printed books offered more reliable information than websites: ‘I thought the books were more trustworthy than the Internet’ (Kathy, Interview, Study 1); ‘I usually think books are better because they’re more reliable’ (Karen, Interview, Study 2); and ‘Anyone can write stuff like on the website and post it as fact. […] It’s a lot harder to post rubbish in books and get them published’ (Chloe, Interview, Study 3). Richard (Interview, Study 2) demonstrated a more detailed knowledge of the publishing process than other participants, and his explanation for considering printed books more reliable includes a reference to author qualifications (which are considered in the section below on post-access reliability criteria):

> Books seem, they seem like they’re more, like they actually know what they’re talking about because they’ve got to go through editors, proof-readers, or they should, um, and Internet’s just like anyone can put up a page but with a book, generally it’s written by, um, people who know what they’re talking about.

Paul also considered printed books to be ‘really reliable’ as a result of having been through the publishing process (‘they have to get past the publisher, so someone has to actually have read through the content, and given a tick of approval’; Interview, Study 3) and had high regard for the publications produced by universities. If Paul found the same information in a *Wikipedia* article as in a book, he would cite from the book because it is ‘easily traceable, it’s very reliable’ (Paul2, Interview, Study 3). Brian (Journal, Study 1) thought that the 1972 edition of *World Book Encyclopedia* that he had at home, for the historical background of his topic, ‘is probably still more reliable than some websites’. Michael thought that it was obvious that printed books were good, having stood the test of time: ‘they’ve been used for so long and […], until the Internet, they were always the no. 1 source for things, you know, entertainment and all that [*tittering*]’ (Interview, Study 2).

A hierarchy of reliability among information sources was evident, with printed books near the top of the hierarchy, as elaborated earlier. For Richard, websites from the Australian War Memorial ‘were the best sort of ones because they’re from the government and they’re a bit more established than *Wikipedia*’ (Interview, Study 3). Data from Paul’s interview

(Study 3) indicate that he perceived a hierarchical relationship of reliability among a set of information sources. He considered a publication of the Australian Music Examination Board on Beethoven to be the most reliable; the website that was the subject of his screen capture, lvbeethoven.com, occupied the middle ground of reliability ('even though … seems … pretty accurate, I can't tell for sure'); and *Wikipedia* was the least credible source. Chloe regarded websites as providing less reliable information than printed books, and her distrust of blogs suggested that such sources were the least reliable online sources: ' "The fall of Singapore, 60 years ago today" – what am I reading? It's just a blog' (Think-Aloud, Study 3). In a similar vein, Lily rejected chat rooms, which she felt contributed trivial discussion not appropriate to her purposes; while relevant, the information was not reliable. On the other hand, when Stefano's search for outcomes of the Falklands War led him to blog-like entries in conversational style that offered people's opinions with their references to anecdotal evidence, such as 'in the case of my dad …', he found the information useful. Likewise, Sophie's use of a forum discussing the novel that she was studying showed that she found the information relevant and, because it was a serious literary discussion, reliable. Participants rated the reliability of online sources according to their purposes, demonstrating that some discussion sites were more likely to supply trustworthy information than others.

Participants considered a selection of individual sources to be reliable; such sources enjoyed a reputation for providing dependable information. Reliability was also attached to groups of resources, such as printed books, which were highly regarded. *Wikipedia* was generally considered to be unreliable, despite being heavily depended upon for the provision of topic overviews. Source reputation formed part of the preconceptions that participants brought to their information search tasks and influenced their decision making.

4.3.2 Post-access reliability criteria

My consideration above of pre-access reliability criteria encompassed participants' decision making that generally took place before viewing the full item; in the case of some reliability judgements relating to source reputation, decisions were made soon after the complete source was accessed. I now turn to post-access reliability criteria, discussing corroboration, as a method of testing reliability; and design, writing style, and authorship as indicators of reliability.

4.3.2.1 Corroboration

The strategy of corroboration predominated as a way of establishing reliability. This took the form of matching prior knowledge with subsequent knowledge. The seeking of corroborating information is a key element in knowledge building: without the prior knowledge, corroboration cannot take place, and without corroboration, there is no building upon that prior knowledge. When new information was encountered, it was matched against existing knowledge and where the new information matched the old, it was used to support the old information. The matching behaviour essential to corroboration is further elaborated in Section 4.4.5.2.

The prior knowledge used by participants in the process of corroboration came from two sources: knowledge held by the participant before the information search task began; and knowledge developed by the participant while completing that task. The latter typically came from the overview knowledge formed from a single source providing an overview; in Section 4.2.3.1 above, on relevance priming, it was seen that *Wikipedia* frequently provided such an overview. The typical process of corroboration is represented in Figure 4.7.

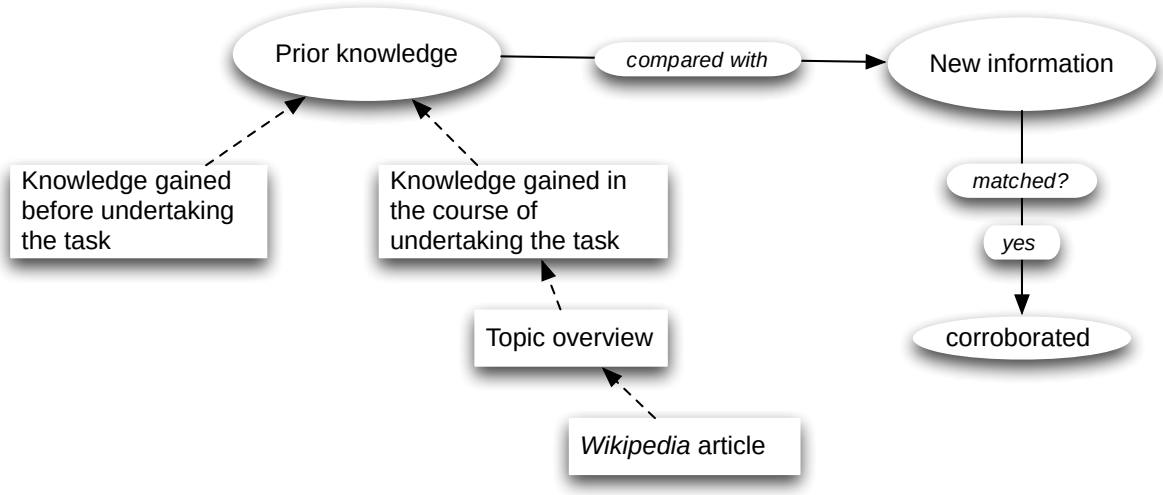


Figure 4.7: Process of corroboration

Participants looked for information in a second source to establish whether the information in an earlier source was accurate. Edward, referring to a *Wikipedia* article as a 'starting reference point for me', said, 'I'll normally just go to the, take the information from that, double-check it with, um, newspapers and independent articles that have been written' (Interview, Study 3); he used the website of the Australasian Legal Information Institute to corroborate information found in *Wikipedia* about three criminals. Kelvin's approach was to undertake further searches to compare information: 'If it says, you know, the speed of sound or something, I'll look at *Wikipedia* and then I'll just kind of put that into *Google* and see […] if kind of across a couple of sites, if all the values match (Interview, Study 1); and 'I will google search the subjects in order to test the accuracy of the information on wikipedia' (Journal, Study 1). Having consulted the Maritime Union of Australia's website for more information on the actions and responses of the Union in the 'war on the waterfront', David said, 'I compared this information to the basic information I had got from the Wikipedia site' (Journal, Study 1); he found 'common information and action and results'. Paul's lack of confidence in *Wikipedia*, unless it had supporting sources, is evident in the following: 'It's really important when you look at these things is that you have some other source of information 'cause some of them could put, you know, some rubbish on *Wikipedia*, and you wouldn't know unless you had some other source' (Paul2, Interview, Study 3). The finding of similar information confirmed the information gleaned from any earlier sources from which participants had built their knowledge.

Matching of information was not always a matter of matching *Wikipedia* information with subsequent information. Non-*Wikipedia* websites, for example, were, matched with information on other websites. Rachel used her textbook and other sources she had read to 'match up' information she was reading with the prior knowledge gained form those sources, saying she would consult her teacher if she were not able to resolve contradictory information. While Rachel used 'match up', Stefano used 'line up': 'I've got other information, I've got other websites, so generally the information tends to line up, it seems to be pretty good, so I just basically go off that and I also sometimes have books'. He had several tabs open in his Internet browser, commenting that they were 'all of general basic information', and that 'all tends to fit in quite well'. Stefano claimed, 'I don't solely go with *Wikipedia*, so if it doesn't line up with a couple of, at least two other sources, then I don't use it' (Interview, Study 3). Paul compared two websites, and found consistency in information about Beethoven: 'It has some, you know, background information about where he grew up and it seemed to match with the stuff on the site' (Interview, Study 3).

Matching information with other information will inevitably give rise to the observation of contradictory information. When Charlotte came across contradictions, her response was to 'look at more and see what's the majority' (Interview, Study 2). Chloe was more detailed in her reaction to contradictory information, but her search for consistency is also likely to have been influenced by weight of sources:

> [*Reading*] "More than one, eleven hundred Australians were killed, two-thirds of all Allied deaths and another fifteen thousand were taken prisoner." Well, that's weird because that's sort of different data than I got. Um, yeah, that's weird. OK, "The fall of Singapore" OK, so what I'll do about the data, so I'll write it down and then I'll have a look at the other stuff, all the other data I've got, 'cause I've written a few down times and if it's, which one's more consistent, I'll go with that; probably not the correct way but I like it [*short, awkward laugh*]. (Think-Aloud, Study 3)

Emily (Interview, Study 2) also portrayed the likelihood of being swayed by volume of sources but, depending essentially on source reputation, added that some sources had stronger reliability and could be used as more forceful corroborating influences:

> I think there might've been a few where they had the wrong dates or something […] I'd, um, look up a lot of other sites, I'd like specifically look for that information and see which ones had the most of one sort of date and didn't have a lot of the other ones […] and also find sites that were more trust-, trustworthy maybe like, um, there's like the *Britannica Encyclopaedia* [*sic*], things like that, things that were not somebody's personal webpage but were sort of a company […] a bit more trusted.

When faced with contradictory information that they were unable to resolve, Rachel said she would speak to her teacher, and Kelvin would approach his father. Paul had a third way of responding: 'Things that can be disputed, I generally say, yes, I put into the document, but then I say, 'This is disputed' (Paul, Interview, Study 3). Paul found what he considered an inaccuracy in a *Wikipedia* article when his prior knowledge held there to be a distinction between 'plebiscite' and 'referendum' while the encyclopaedia article treated them synonymously.

In addition to finding contradictory information when comparing information, participants sometimes found redundant information. Victoria (Think-Aloud, Study 3) noted repeated information: 'same stuff I've read in books and *Wikipedia*'; and 'something I've already got'. Victoria was disappointed when a source she was consulting did not assist her to resolve the contradictions she had observed in earlier sources: 'the point this doesn't bring up is the inconsistency of the numbers' (Think-Aloud, Study 3). Victoria's focus on finding figures shows a simultaneous search for relevance and, with her desire to corroborate, an intention to establish reliability. Maria suspected copying and pasting when she observed the replication of information: 'We read over lots of websites but a lot of the websites had the same information on it, I think the exact same' (Interview, Study 1). While redundancy and corroboration are related, in that corroboration entails an active searching for redundancy, and when redundancy is observed it sometimes serves to corroborate, the illustrations in this paragraph exemplify instances of redundancy that indicate to participants that the redundant information requires no further attention.

Allied to the noting by participants of redundant information is their observation of novel information. Such information is used to fill the gaps that they have in their understanding of their selected topic. (See also Section 4.4.5.)

When matching information with their prior knowledge, participants found contradictions or consistency. They also noted a particular kind of consistency, namely redundancy, which acted as a cue to consider that information no further. Generally, however, consistency led to the confirmation of the accuracy of the information in a process of corroboration. Though difficult to establish from my data, the process of corroboration appeared to be incidental, that is, a by-product of a continuing search for information, rather than intentional. Corroboration merges the functions of searching for relevant information and searching for reliable information, in that looking for new information that matched old required a search for relevant information and, when a match was found, the process of corroboration established the information as reliable. The comparing of new information with old, then, performed at least two major functions: the identification of information that could be used to create a fuller picture of the topic; and the detection of information that had the potential to corroborate prior information and thereby contribute to knowledge building. It may be that the latter process is akin to a consolidation process, with the correspondence between the information acting as a catalyst to consolidation.

4.3.2.2 Design

The design of the information presented influenced how participants rated its reliability. They also interpreted poor design as indicative of a lack of effort having been put into the presentation of the information. Three students, particularly, discriminated between sophisticated and unsophisticated website design. Design, in the current study, relates to elements such as typography and layout, and includes the use of colour and the employment of advertisements. As a factor in the decision making of participants in the current study, design relates exclusively to online sources.

A website needed to look reasonably professional for participants to consider it reliable; in fact, they were highly likely to overlook it in favour of another source if they assessed a website as amateur. Charlotte distinguished, on the basis of their layout, between sophisticated websites and those that were not. It appears that the credentials of the author (see Section 4.3.2.4) came second to this factor for her, indicating that a negative assessment of a website's appearance may be sufficient to exclude it from consideration and, potentially, to deny the seeker information written by an expert. She considered a site unsophisticated if 'you get little things popping up saying, oh, you know, "Press the joke button" blah blah blah' (Interview, Study 2). Edward came close to rejecting a website that was '[a] bit gimmicky but not too bad' (Think-Aloud, Study 3). Mary-Ann (Think-Aloud, Study 3) was attracted to sites that were 'professional looking'. A problem with the formatting of inverted commas, which were rendered as 'question marks in little bubbles', made Chloe feel that she 'didn't really want to read it' (Interview, Study 3). Black text on a red background, which made it difficult to read, even though it was a reproduction of a *Sydney Morning Herald* article, caused Chloe to turn away. (Edward considered the newspaper a reliable source, and Chloe may well have, had she been able to overlook the grating design.)

Simple, plain presentation of text appealed to participants over text that appeared to be working too hard to attract their attention. Karen (Interview, Study 3) indicated her hierarchy of reliability when she said, 'I think if it's too showy and has like too many advertisements, like, I'd kind of stay away, wouldn't stay away, […] but I'd be, like, "This probably isn't as, like, dependable as, like, a boring one" '. Stefano preferred black text on a white background over 'colourful backgrounds and all pretty pictures' and 'moving borders', articulating the effect of plainly presented text as follows: 'It says a lot to me, they actually know what

they're doing, they're not concentrating on making it look fancy to appeal to a child or someone' (Interview, Study 3).

For Richard, poor design was symptomatic of a lack of effort having been put into the website: 'they don't look like there's much design put into them … so I look at them and I think, well, that's probably not the best one to choose' (Interview, Study 2).

Participants rarely commented that good design made information more convincing; in one case a site looked 'scientific' and scientific information was what the participant was seeking. However, they regularly referred to the negative impact that poor design had on credibility. Inappropriate choices of typeface and jarring colours in website design were enough to discourage a participant from fully trusting the information.

4.3.2.3 Writing style

The style of writing employed by the author of the information source played a part in participants' judgements about the reliability of the information. Writing style is a factor that overlaps considerably with other reliability factors, such as source reputation (discussed in Section 4.3.1.2), particularly the reputation of printed books, whose reputation for reliability was assured among participants. Authors' style appeared to be of most interest to participants in relation to free online sources. Style may also be bound up with authorship, particularly when it conveys the impression that the information has been written by a person knowledgeable about the topic area. Similarly, depth of topic treatment is sometimes not easy to separate from impressions of style.

Poor writing style indicated low reliability to participants. I referred above to Lionel's view that a *Wikipedia* article was badly written, which led him to avoid it as a source of 'grounding knowledge' (Interview, Study 3). For Edward, style took precedence over author expertise: 'if it was poorly written, I probably wouldn't bother with them, even, no matter how good the, um, author is' (Interview, Study 3). The intended audience of a piece of writing also affects the style adopted by the author; exploring the personalities of criminals, Edward was looking for websites that were addressed to psychologists and psychiatrists: 'the first, um, I guess, a priority, was to make sure that, you know, it was a doctor's thing, or doctor's website or

something along those lines but then, you know, language also does, um, play a significant role' (Interview, Study 3). Not only did style influence Edward's judgement, he also used his perceptions of audience, which he first noticed in the snippet, which told him that the site related to 'so-and-so's mental clinic'.

Distinctions between fact and opinion were sometimes discerned through writing style. When Gerard noted, from the style of writing, that he was reading people's opinions about the future of mining in their area, this triggered his application of his heuristic that subjective opinions were irrelevant to his purposes. The relative informality of blogs gave rise to mistrust of the information, being described as 'not official' and being written 'from the top of their head, not any sort of effort' (Chloe, Interview, Study 3). Such a judgement of information in blogs as unreliable parallels Lily's suspicions (Interview, Study 1) about the trustworthiness of the informational content of chat rooms. In these instances, relevance and reliability are intertwined: the opinions of people writing in these environments were deemed irrelevant because participants were looking for objective analysis, and those opinions were considered unreliable because of their subjectivity. Although the expression of opinions, particularly in an informal way, may occur in a particular writing style, source reputation (see Section 4.3.1.2) is sometimes a stronger indication to the participant not to trust the information.

When authors presented a good argument, through the evidence marshalled, the information source was perceived to be trustworthy. Karen (Interview, Study 3) shared her impression of information in a website, that 'it sounded like a really good argument', supporting that with the following: 'he actually had evidence 'n' discussed it in depth and stuff'. The link with writing style was evident when she commented on 'his way of writing, like he actually sounded intelligent', and that 'I thought it sounded like a professor and he had all his references to actual historians and stuff that they sound like they would've been saying'. Participants' perceptions of what constitutes a good argument are closely related to their perceptions of author expertise and depth of topic treatment. Mary-Ann perceived *Encyclopedia of Earth*, a free online source, to be 'a major site', not only from its size but also from its formal, academic conventions of supplying 'further reading and citations and things'; she concluded that it was 'pretty decent' and not 'just someone's made their own little web page' (Interview, Study 3). Depth of topic treatment (Section 4.2.3.3), as a factor of relevance, indicated sufficient material at the level of detail needed; as an indicator of reliability, depth of topic treatment serves to persuade participants that the author is able to

present in-depth information, thereby establishing that he or she is knowledgeable about the topic and able to be trusted.

Participants were more inclined to believe information written in a style associated with academic writing. They were attracted to good argumentation; longer pieces of writing, which they associated with depth of topic treatment; and writing that provided citations and references. Opinions expressed in an informal style were considered to have little or no reliability. Dimensions of good writing are not mutually exclusive; for example, a source of acceptable length may also coincidentally treat a topic in the appropriate depth, and a source that has a persuasive style may achieve that through the use of carefully presented evidence.

4.3.2.4 Authorship

Authorship, as a factor in reliability judgements, is richly connected to other factors, such as source reputation (Section 4.3.1.2), clues in URLs (Section 4.3.1.1), and style of writing (Section 4.3.2.3). Participants' inability to trace details of the authorship of *Wikipedia* articles seemed to be at the heart of their mistrust of the encyclopaedia, even if such mistrust was absorbed from teachers. Participants held the opinion that the credentials of authors were important to consider, but the data provided very few examples of participants actually investigating the qualifications of authors.

Karen concluded from the style of writing that the information had been written by a professor or, at least, by someone with expertise in the area, without apparently tracing details of the author. She acknowledged that anyone in the online environment could pose as a professor. When asked who the authors of a particular source were, Karen could not remember, but added that it did not have commercial connections; she then commented on a habit: 'I don't usually check for the authors', suggesting her reliance on impressions gained from writing styles and other conventions.

The authorship of printed books posed fewer problems for Kathy than the authorship of Internet sources because printed books made the author explicit, while it was difficult to trace authors in Internet sources. Kathy (Interview, Study 1) talked about the ability to 'look up the author and see where they are coming from, how they did their research for the book' but reported that she 'couldn't find many at all' when using Internet sources. Richard's comment

that printed books are generally written by ‘people who know what they’re talking about’ was cited above. There was widespread acceptance among participants that printed books were reliable sources; a strong contributing factor to their perception is their belief that the print publishing industry has a process for vetting the qualifications of authors.

In Section 4.2.2.5 above, where I outlined the distinctions made by participants between fact and opinion, I referred to Lily’s criterion of the intelligence of the author; she regarded book and movie reviewers as falling into the category of ‘intelligent people’, distinguishing them from the average person expressing his or her opinions on the Internet. After layout, as a factor in Charlotte’s assessment of sophistication of a website, came the author: ‘where the information comes from, it’ll usually say on the web page, if it’s come from a specific person, um, it might be a person who’s well-known or a person that’s, um, you know, properly trained, like a professor or something particular’ (Interview, Study 2). Edward relied on information about criminal behaviour ‘written by a doctor or someone along that profession’, saying that, ‘for reliability, you look at the author’. Later in the interview (Study 3), Edward elaborated on the role of author qualifications with respect to what he referred to as the authenticity of information: ‘Normally if they have, like, a, their experience or university degrees or something like that next to their name, it does play a huge role in determining […] if you go through with the site or not’. Michael also accorded high status to doctors as authors when he referred to tracing the author of a *Wikipedia* article, although he appears to have been referring to the citations used in such an article: ‘if it says like a doctor wrote it or something, […] it needs to actually have proof that it’s a really good, you know, piece of work’ (Interview, Study 2). Participants viewed formal qualifications as necessary for authors of Internet sources, and appeared to take any statements of qualifications at face value.

The lack of author details in a *Wikipedia* article was sufficient to make Paul regard another website with its author’s name on it as more reliable: ‘it looks more credible than *Wikipedia* since it had an author at the bottom and, you know, some citations’ (Paul, Interview, Study 3). Displaying scepticism about its authorship, Rachel avoided relying on *Wikipedia* for statistical information: ‘When I actually get information for the speech, like, if there was any statistics or anything, I try not to use them from *Wikipedia*, ’cause it *is* just like any old bum can write it’. Given participants’ strongly held view that teachers disapprove of the use of *Wikipedia*, and that this disapproval is based on the inability to identify its authors, the students in the

current study have almost universally absorbed the message of unreliability from the older generation. Curiously, however, the message is not believed with sufficient conviction for participants to change their practice.

My data provided evidence of only one participant having paid attention to the status of information in a *Wikipedia* article: 'Notice "Article requires cleanup – info may be unreliable" therefore don't pay much attention to the information particularly details' (Brian, Journal, Study 1). Brian's reaction, to use general details, rather than specific ones, is in keeping with the general use to which participants put *Wikipedia* articles, that is, to employ the broad framework offered by the article, but to verify specific details by performing a *Google* search for other sources covering those particulars.

Some URLs provide clues to the author of the information. These clues were considered above, and so will be treated only briefly here. Websites authored by government agencies and educational institutions were considered trustworthy, as were those with URLs which identified them as having originated in organisations, as opposed to commercial companies. Edward's observation of 'smh' in a URL, to indicate the *Sydney Morning Herald*, signalled reliability to him because of his trust in the source to provide accurate information.

Writers of blogs and contributors to chat rooms were not seen as providers of reliable information. This was treated above in relation to participants' views of categories of source; the reputation of the source seems to be the overriding consideration when participants examine a set of results returned by a search engine and the set contains blog, chat room or forum sites. There were occasions, however, when forums, for example, were appropriate to the needs of participants, as outlined above.

The Internet offers examples of school students publishing their assignments on the World Wide Web. When participants came across such examples, they rejected them as unreliable. Ryan (Interview, Study 1) said that it was easy to tell if a source was 'a three-year-old's assignment' or not, and if it was 'a school assignment that they just put up as a web page'; he discounted such sites because 'you want a bit of brains behind it, I guess'. In relation to essays written by students, Sophie was not impressed by their authors' lack of knowledge: 'I found essays people had done and I looked at them; they weren't people who knew a lot' (Interview, Study 2).

Impressions of the level of qualifications of the author appear to have been more influential in reliability judgements than verification of those qualifications, and sufficient to make such judgements without the follow-up of an actual investigation of the author's qualifications. Participants possibly drew from a stock of experiential wisdom, based on observations that particular writing styles are associated with authors with particular sets of qualifications; equally, participants may have been socialised into accepting certain markers, particularly of writing style, as evidence of authorship by people with the appropriate credentials. If the latter were correct, authorship could be subsumed under writing style.

4.3.3 Conclusion to research question 2 (reliability decisions)

In answer to the question of which criteria students used in their decisions about the reliability of information, the current study has noted that participants employed two sets of reliability criteria: one set was applied, for the most part, while examining search results, that is, before any individual source was accessed (pre-access reliability judgements); the other set was usually applied after the participant had consulted the full source (post-access reliability judgements).

In pre-access reliability judgements, participants considered URL properties a guide to the reliability of a source, and they also held opinions relating to the reputation of sources. Source reputation was applied to an individual source as well as to a group of like resources, and was a preconception, based on prior experience, brought to the search task by the participant.

Post-access judgements of reliability noted were: corroboration; design; writing style; and authorship. The need to corroborate information was dominant and had three outcomes: when information matched, it was taken as reliable; when information was contradictory, the participant needed to resolve that; and when information was redundant, prior knowledge was confirmed and the participant no longer needed to devote cognitive resources to it. Judgements of design, writing style and authorship were largely subjective, with poor design, informal or non-academic writing, and impressions of a lack of expertise being sufficient for the participant to conclude that the information lacked trustworthiness.

4.4 Research question 3: The context of relevance and reliability decisions

In this section, I move to the broader context in which participants' decisions about the relevance and reliability of information were made, having discussed above the factors employed by the secondary school students in my study to assess relevance and reliability. The social environment is the broader environment of the educational setting of the study; combining the social environment and the educational setting, I have called this the *socio-academic context* and identified it as a theme that pervades participants' decision making. Following that is the theme of *convenience or pragmatism*; this theme is evident at the individual, more subjective level and permeates decision making. The next three themes examined below, those of *relevance priming*, *relevance chaining*, and *knowledge building*, are process-oriented themes and reflect what participants did, as opposed to what influenced them in the socio-academic context or what motivated them to take a pragmatic approach. The five themes are presented in Figure 4.8 below.

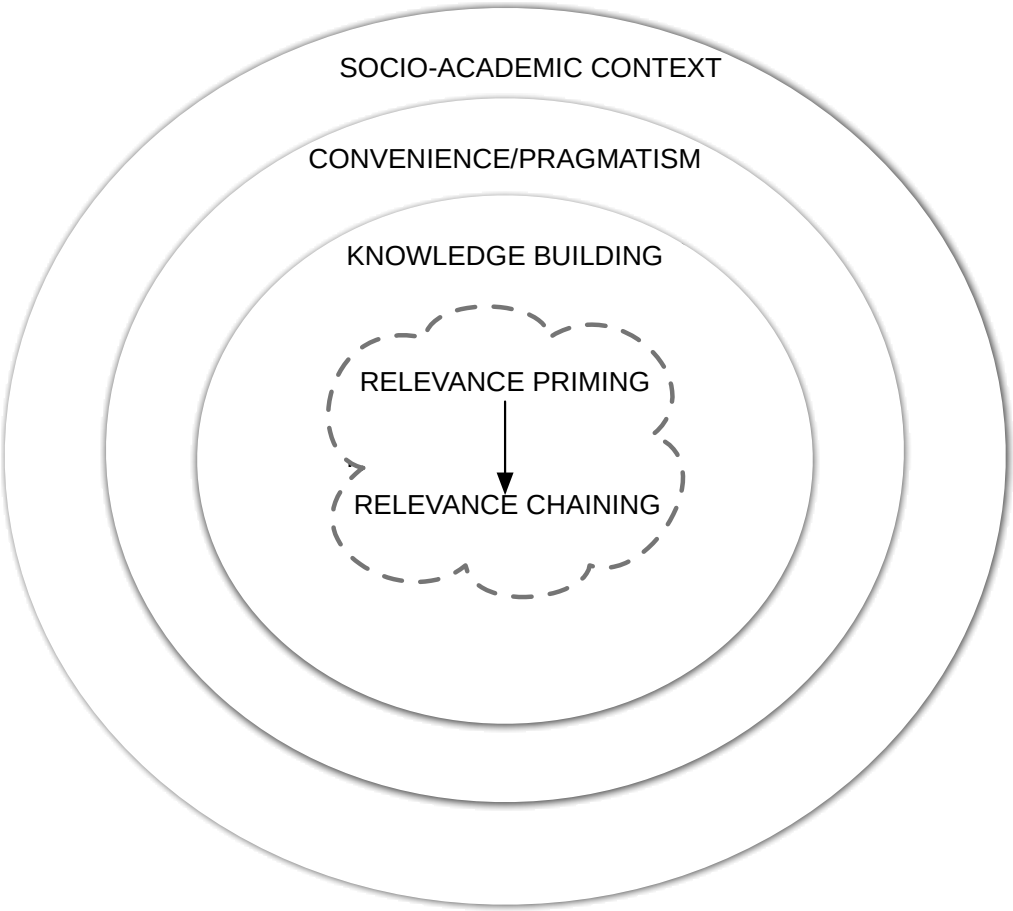


Figure 4.8: The five themes and their interrelationships

The five themes (socio-academic context, convenience or pragmatism, relevance priming, relevance chaining, and knowledge building) crystallised around an entry in Kelvin's journal in Study 1. I reproduce it below, with interpolations in italics to show where the respective themes are illustrated:

> I find this to be a somewhat effective method for gathering information, as it is usually very easy to do [*convenience: finding information is easy*], however, if there is no wikipedia article on a certain topic [*relevance priming: a topic overview facilitates the task*] then it is sometimes hard to find enough information, as a lot of the results given by a google search need close filtering to find any worthwhile information [*knowledge building: filtering information*]. The reason that I prefer to use wikipedia is because it is so easy to use, and it is usually written in language I can understand. Also, contrary to what most teachers will have me believe [*socio-academic context: influence of teachers*], I find the information to be accurate; as I have not yet found one mistake on wikipedia [*relevance chaining: subsequent searches corroborated information*].

The inter-relationship of themes and the criteria employed by participants in relation to relevance and reliability are displayed in Figure 4.9a, in which relevance criteria appear on a green background, while reliability criteria appear on a yellow background; where the same criterion may be used in both relevance and reliability judgements, both green and yellow have been used in the background of the text box. While Figure 4.8 presented the five themes as interrelated circles, in Figure 4.9a they are presented in an expanded diagram for clarity. The overlapping circles of Figure 4.8, however, are a more accurate representation of the overlapping nature of the themes.

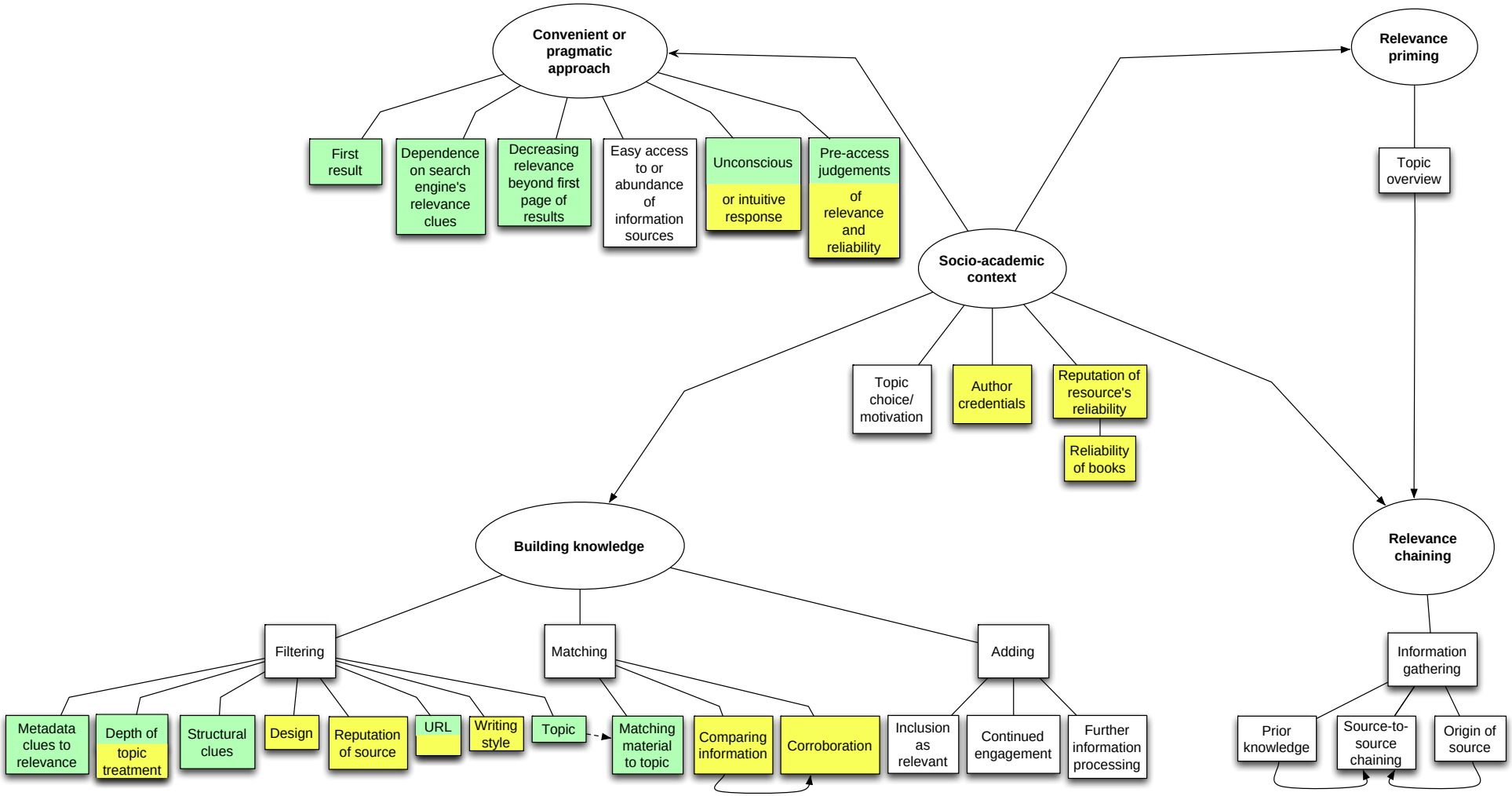


Figure 4.9a: Five themes, showing their relationship with relevance factors and reliability factors

(Relevance factors shown on green background; reliability factors shown on yellow background; overlapping factors shown with both)

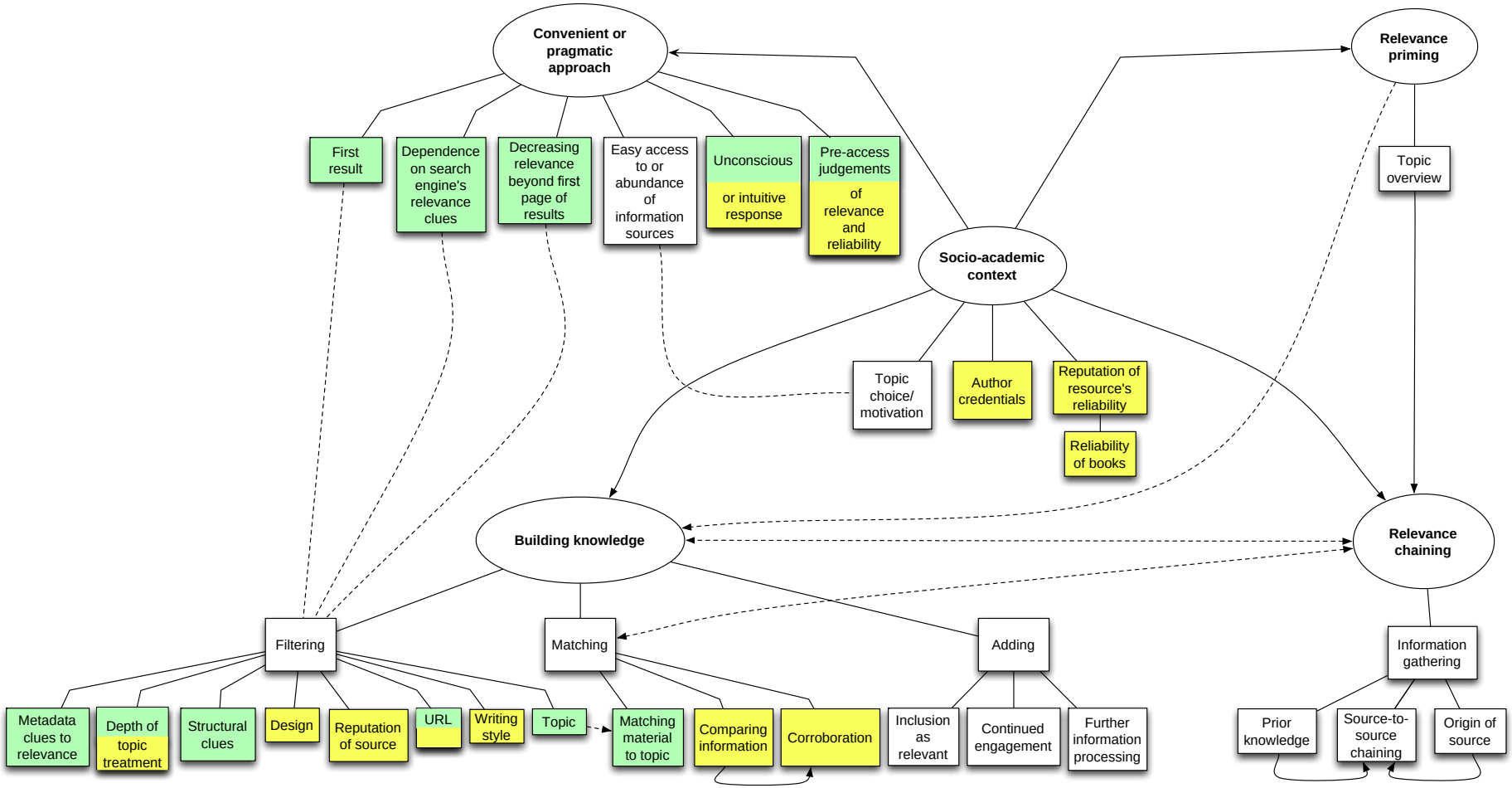


Figure 4.9b: Five themes, showing their relationship to relevance factors and reliability factors, with additional relationships denoted by dotted lines (Relevance factors shown on green background; reliability factors shown on yellow background; overlapping factors shown with both)

In my exposition of the five themes below, I shall be treating quite briefly those that simply need linkages to the results above, whereas other themes need more elaboration to show their connection with the results. Themes are not discrete and thus interrelationships are evident, as denoted by dotted lines in Figure 4.9b, which offers a selection of some of these interrelationships.

4.4.1 Theme 1: Socio-academic context

I use *socio-academic* to mean the combined social and academic contexts of the student, including the social relationships that are experienced during academic activity. This theme indicates the environment in which the activities of the other themes take place, and is slightly narrower than the sociocultural context. The theme of students in their socio-academic context is evident in such phenomena as interactions with teachers, parents, siblings and other students. Other contextual factors include students' attitude to formal assessment. The former phenomena are evident in the data of the current study and I have restricted my attention to these even though the socio-academic context is wider, and includes, for example, social and political expectations of the broader society. Like the students in Fidel, Davies, Douglass *et al*.'s (1999:28) study, searching was 'both a social and an academic event' for participants in my study. Jones, Estell and Alexander (2008) refer to the role of family, peers and community in the acquisition of information through the modeling, vicarious experiences and direct guidance provided by these agents. Theme 1 corresponds closely to Williamson and McGregor's (2006) theme of people; however, I distinguish it from the broader 'sociocultural' context, as used by Lloyd (2007). (Data extracts relating to the socio-academic context appear in Appendix 4.3. The data extracts are, by and large, representative samples; however, on occasion, the data sample may be the entire data coded in that category for a particular participant. In some instances, a cell contains the following note: 'No data categorised for this participant'. In such a case, no data in any of the data forms appeared to match that category. References to Appendices 4.3-4.7 are in the form of 'Column.Case'; thus, 'A.1' refers to Column A, Case 1.) The influence of family members, teachers or peers on topic choice is illustrated in Appendix 4.3 at A.7, A.12, A.14, A.15, A.25, and A.27.

Judgements about the relevance and reliability of information were influenced by students' experiences before the students had begun their searches for information to complete the tasks set by teachers. Students approached such tasks with preconceived notions about which

sources were likely to offer relevant information. This was seen in their dependence on *Google* as a search engine, or gateway, that would provide consistently relevant sources on its first page of search results; this was also observable in their attitude to *Wikipedia*. Past experience had shown students that *Wikipedia* offered useful introductions to their study topics and would thus provide a suitable framework to develop further knowledge. These experiences had become part of the fabric of their socio-academic experience. (Data illustrating that preconceived personal beliefs about sources, or particular categories of sources, were used in judgements of reliability appear in Appendix 4.3; see A.1, A.2, A.4, A.5, A.8, A.11, A.14, A.16, A.18, A.19, A.20, A.21, A.22, A.23, A.24, A.28, A.29, A.32, A.33, A.34, A.35, A.36, A.37, and A.38.)

Students were grateful for the teacher bringing particular resources to their attention and acknowledged that they would not have otherwise used these resources, particularly printed books. Students appreciated the personal interest shown in them by their teacher. The choice of a unique topic by each student, or pair of students, made it possible for the teacher to relate on an individual level to meet students' needs. The teacher's professional behaviour to facilitate learning was interpreted by students as taking a personal, socio-academic interest in their individual tasks.

Parents supported their children, most commonly by reading drafts of their children's work and offering suggestions on style and technical aspects. They also assisted by developing an awareness of audience when suggesting which terms required definitions to be more readily understood by the student's audience. Older siblings also played this role for some participants.

Despite students having teachers, parents, siblings and student partners to help, most students were not overly dependent on them: they completed their tasks with a high level of independence. Louise, the teacher of participants in Study 1, felt that students were often 'very independent in their studies and what they want to do; some don't want help at all with what they're doing and sometimes put up barriers to suggestions'. She speculated about whether this approach was based on their confidence in their skills or whether they 'wanted to surprise you' with the finished product. Possibly, like the college students in Brown, Murphy and Nanny (2003), the students in Louise's class were so confident in their perceived levels of

skills in the digital environment that they did not feel the need for skill development in information literacy. Brown, Murphy and Nanny (2003:397) refer to this as the 'dichotomy between computer and information literacy'. Ferguson, Neely and Sullivan (2006) found that students overestimated their skill levels. Whitmire (2003:140) notes that undergraduates' epistemological beliefs influenced whether they would request help to find sources of information: 'undergraduates … at the higher stages of epistemological development are more likely to seek assistance from reference librarians'.

4.4.1.1 Topic choice

Topic choice is of interest in a study of relevance, given its role in the early part of the chain that, through a student's prior knowledge, affects what a student will deem relevant. Parents, siblings, and teachers were important players in the socio-academic context, influencing topic choice. Amber's topic about the role of early women settlers in Australia was motivated by her mother, who 'has a lot to do with women's rights and that sort of thing and so I've like grown up with that sort of stuff and that sort of influence' (Interview, Study 2). Mark shared an interest in cricket with his father and he built on his prior knowledge when exploring diplomatic relations between England and Australia in the 1930s: 'I watched, like, last year with my dad, like this whole like series on the Bodyline. It was like seven episodes of like half an hour, it was real boring, […] but I like cricket …' (Interview, Study 2). An older sibling's academic interests at university influenced Vicki's choice of topic:

> My sister was studying genocides at uni, and some of the things she was telling me really got me interested and I was surprised to hear about so many genocides that have happened since, um, kind of behind our backs and that we didn't really know about them' (Interview, Study 1).

Not only was Vicki's sibling a potential source of resource material, as Amber's mother was, but she also assisted in the development of an early focus in her sister's search as a result of their discussions. Michael related his experiences of investigating two topics, both of which were motivated by family members: 'the reason I chose St Kilda was because personally and my whole family are involved in AFL [Australian Football League]' (Interview, Study 2); and

his interest in the Hiroshima and Nagasaki bombings was piqued by stories related by his older sister after her visit to a museum in Japan.

Teachers' influence on topic selection was obvious from the topic choices they offered students in assignments but was also evident when they assisted students to narrow topics, once students had made individual selections. Chloe selected a topic requiring her to examine a great Australian, but 'I struggled to think of someone so I asked [*teacher's name*] and he gave me a list of people he thought might be good and then I chose Matthew Flinders off the list' (Interview, Study 2). Through seminars presented by students in History, Karen became interested in the contrast between the preparedness of Russia and Germany, respectively, for the Second World War, and so pursued that when offered the opportunity. Emily brought knowledge gained in Art to bear on her History assignment; she had learned 'a bit about different Art movements so I already have a bit of background knowledge in some of them, which helps me look for certain artists I like or things like that, […] which makes it a bit easier to research, yeah' (Interview, Study 2). Vicki's interest in researching genocides (above) was also influenced by her study of the Nazi holocaust the previous year. Jake chose his topic after a discussion with his teacher: 'I [was] talking with [*teacher's name*] and then we just asked him about racial inequality and then he related it to African Americans to what was happening in Germany at the time'. For Elizabeth (Interview, Study 2), the interaction was less direct; the design of the task offered the freedom to choose a topic of personal interest:

> We could choose any topic we wanted and choose anything that interested us in that time period and, um, [*teacher's name*] had like lots of questions you could do, a world one and an Olympics one, and the Olympics were on at the time so I just did that, because it was interesting.

Students chose a topic based on some interaction with teachers, whether in face-to-face discussion, topics previously covered in the curriculum, or open-endedness of topic choice incorporated in the task. While teachers clearly influence several aspects of the presentation of curriculum, the focus in this section has been on the direct influence of the teacher on the topic choice, as perceived and articulated by the participants. Prior knowledge assisted

students to note relevance when searching for new information to add to their existing stock. Relevance chaining is a productive activity when based on a rich stock of prior knowledge. Important players in the socio-academic context, teachers and family members participate in the development of prior knowledge, which subsequently motivates topic selection.

4.4.1.2 Author credentials

Author credentials were treated in Section 4.3.2.4, which noted that judgements about authors' qualifications were based on impressions of writing style. Although students displayed theoretical knowledge that reliable sources were written by professors and doctors, for example, there is doubt that they established who the authors were. They did not trust the informal writing of sources such as chat rooms and blogs. Their distrust of *Wikipedia* was based on the absence of identifiable authors and was substantially influenced by teachers. Students' impressions of writing styles had been built up over the course of their academic careers. Although they had absorbed the theoretical lesson from teachers about identifying authors and their qualifications, students generally appeared to have failed to apply this lesson. Given the success of their methods, however, demonstrated in the rewards of acceptable grades from teachers, participants apparently saw no reason to revise their approach. A heuristic of this nature was adequate in the socio-academic context in which students were operating; it was a time-saving strategy consistent with an approach marked by convenience and pragmatism, which is elaborated in Section 4.4.2.

4.4.1.3 Printed books

Students' trust in printed books as reliable sources of information stems from factors in their socio-academic environment. Knowledge of the book publishing process, students' perceptions that teachers disapprove of *Wikipedia*, and the requirement of teachers that printed books be consulted in the preparation of students' assignments, are the strongest factors. Views in relation to the reliability of a source, or category of sources, were influenced by members of the student's socio-academic environment, particularly teachers (see Appendix 4.3 at A.9, A.11, A.13, A.21, A.23, A.26, A.27, A.29, A.31, A.33, and A.39).

Section 4.3.1.2 indicated the trust of participants in the qualifications of authors whose work is published by traditional print publishers. The vetting of such authors was seen as printed books' main advantage, which was contrasted with the situation of the Internet, where anyone of any background is able to publish information.

The mistrust of Internet sources appears to be a value absorbed from teachers and, perhaps, parents. This mistrust, however, appears to be theoretical, or perhaps superficial, as it was observed to be insufficient to dissuade participants from using sources for which they had not traced author details. Data extracts in Tables 4.3 and 4.4 above demonstrate a widespread, claimed mistrust of *Wikipedia* as a source of reliable information. The role of teachers in propagating the belief in *Wikipedia*'s unreliability is encapsulated in a comment from Karen: 'I don't think the History teachers like you to have, like, *Wikipedia* as your reference, kind of thing, so that may be why I'm a bit more biased towards it or something' (Interview, Study 3). Paul, when asked about the basis of his mistrust of *Wikipedia*, replied, 'Even though they source it and everything, I don't know who writes it, and, besides, teachers always tell me you can't source *Wikipedia* because it's not a good thing to do [*upward inflection*]' (Interview, Study 3). Paul was unable to recall teachers' reasons for their advice, and speculated somewhat facetiously that teachers themselves had unthinkingly been socialised into the belief: 'I think it's just, I think it just runs down, you know, the teaching line, "Don't use *Wikipedia*" '(*ibid.*).

Only two students in the study were satisfied with the reliability of information in *Wikipedia*; only one of these two students was of the opinion that teachers approved of the encyclopaedia: 'It just seems to be what everyone's using these days, and teachers actually seem to be quite happy with it' (Stefano, Interview, Study 3). Stefano's comment also conveys his belief that the use of *Wikipedia* is widespread in the modern era and has gained social acceptance. The second of the two participants willing to voice their trust in *Wikipedia*, Kelvin, simultaneously confirmed teachers' attempts to inculcate mistrust of *Wikipedia* and dismissed such attempts as invalid: 'contrary to what most teachers will have me believe, I find the information to be accurate; as I have not yet found one mistake on wikipedia' (Journal, Study 1).

For some assignments in the current study, it was mandatory for students to use printed books. Elizabeth said, 'Books are better and plus you have to use books anyway' (Interview,

Study 2). Amber also explained the teacher-induced compulsion to use printed books: 'We *have* to use books in this assignment'; however, she followed that soon afterwards with 'like you don't *have* to use a book, it's not compulsory'(Interview, Study 2; participant's emphases).

I took the latter comment to mean that the use of printed books was strongly encouraged by teachers and was likely to lead to better grades. When a task was not for assessment purposes, Paul used *Wikipedia*, but, for an assessment task, 'as soon as any referencing comes into play, I'll go find books' (Paul2, Interview, Study 3). Students perceived that source types are arranged by teachers in a hierarchy of preference, so that the use of printed books will be more rewarding than Internet sources; the hierarchy of preference is essentially a hierarchy of reliability, and is also intertwined with the awarding of higher grades when behaviour follows the socio-academically accepted hierarchy. The expectation that students will conform to teachers' notions of reliability is pronounced.

Students' use of *Wikipedia*, paradoxically, shows both their trust and distrust of the encyclopaedia: they trust it as a source offering introductory information but distrust it as a source that will allow them to portray themselves as users of credible information; admitting to its use would be taking a risk in the sociocultural context of the school, in which students are convinced that teachers do not consider its use to be consistent with scholarly endeavour. Apparently, the higher the stakes (as assigned by assessment weighting, or by desired grade), the more rigorous are students' reliability criteria, or those that they perceive are valued by their teachers. In the socio-academic context of the school, students have found it good enough to employ a prime criterion, relevance, and to consider reliability to be a subset of relevance (in the sense that only information judged to be relevant is further considered, if at all, for its reliability). The relevance of a *Wikipedia* article can then be harnessed, and yet never cited, maintaining the charade of its unreliability.

4.4.2 Theme 2: Convenient or pragmatic approach

Students adopted approaches to their information search tasks that may be described as convenient and pragmatic. Their strategies for completing tasks expended the least amount of effort that would give them the most return; to that extent, their strategies were convenient. Students demonstrated pragmatism in their 'get on with the job' attitude to tasks. The most

convenient approach or resource was used because it was the most efficient, and generally it was also the most effective. Acquiescence to perceptions of teachers' attitudes to *Wikipedia* was pragmatic. Participants' appropriation of the first or early results from a search engine, and the non-use of results beyond the first page of results, was convenient. Dependence by participants on relevance clues provided by a search engine was expedient, as was drawing on their rules of thumb when making pre-access judgements of relevance, described in Section 4.2.2. A convenient or pragmatic approach is bound up with students' decisions about how much time and effort to expend on a task; such decisions, essentially about economies of time and effort, may equally be considered ecological for demonstrating students' reactions and adaptations to their scholastic environment. (Data extracts relating to a convenient or pragmatic approach appear in Appendix 4.4. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

Of the five themes identified, this is perhaps the least strongly drawn one. It is evident in aspects such as students noting that the research process lacked challenge. The word 'easy' appeared regularly: Jenny spoke of going to *Google* because 'it's a pretty easy, um, thing' (Appendix 4.4, A.1); Lily found it 'pretty, like, easy to do your own [research]' (Appendix 4.4, A.4); Kelvin found *Wikipedia* 'so easy to use' (Appendix 4.4, A.11); Sophie's interest in a topic was motivated by her perception that it would be easy (Appendix 4.4, A.16) and, when she participated two years later, noted that *Wikipedia* was 'pretty easy' to use because of its concise information (Appendix 4.4, A.33); Rachel found searching for information 'pretty easy' (Appendix 4.4, A.23). Only Lionel, providing a rare negative instance, acknowledged that the specific information he sought was proving challenging to find: 'this isn't going to be all that easy' (Appendix 4.4, A.30).

Participants were clearly mindful of teachers' expectations, as was evident in references to the socio-academic theme above. Such pragmatism achieves the desired outcome, that of an appropriate grade; expending one's energy on a strategy not conforming to teachers' expectations is implicitly futile. Students felt obliged to hide the utility of *Wikipedia* from teachers, by disqualifying the encyclopaedia from inclusion in students' bibliographies (Appendix 4.3: A.21 and A.33). The approach is pragmatic in the participants' socio-academic context.

Convenience was a motivation in relation to topic choice. Given her mother's interest in women's issues, and knowing that her mother's associates would also be able to help, Amber felt that she would have easy access to people with expertise in her chosen topic area. Rachel picked what she perceived to be a controversial topic, the dropping of atomic bombs on Hiroshima and Nagasaki, and correctly anticipated that information would be in plentiful supply. She had been concerned that the Australian angle required in the Second World War topics would have been difficult to cover: 'some of them were on Australian stuff that, there's not so much about Australia' (Interview, Study 2). Availability of information also influenced Kelvin: 'This seemed like a good topic to choose … because of the vast amounts of information there is available on the topic' (Journal, Study 1). When asked about how he selected from the seven topics offered, Kristian replied, 'I looked them all up and figured out which had more information and picked that'; he vindicated his approach with the comment, 'Compared to other assignments I've done, researching, it was less frustrating trying to find information because there was more information available' (Interview, Study 2).

An expedient approach is not necessarily associated with a lack of engagement. While Kristian's rationale for making his selection indicates expediency, it was clear from other parts of our interview that he had engaged with the material. He processed the information that he had found and came to personal understandings about the social, economic and cultural aspects of his topic. Occasionally, the lure of a plentiful supply of information may prove a poor basis for selecting a topic. Sophie said that 'there was quite a lot of information but not really the sort of information I wanted'. She was not prepared either to accept any loosely connected information to complete the task or to adapt her topic to fit the available information resources; her engagement in the task is indicated in her filtering of what she had found initially.

Easy access to information and familiarity with a routine approach to finding relevant information are interrelated; repeated experiences with a resource that is readily accessible and offers the needed information both encouraged repeat visits and developed skills in using that resource, so developing a comfort with its use. Michael found Internet information the most useful ''cause it's easier to access than books'; for him, '*Google*'s the No. 1', and he underlined the search engine's ease of use: 'I […] look in *Google*, it's pretty simple'. He also emphasised the expediency of his approach when he said his was 'a good way of doing it, but it's not always the right way, but it can work'. Michael rarely found searching for information

to be challenging, except in topics that he considered narrowly focused: ‘I don’t really think there should be that many [problems], […] considering we’ve got like the Internet we’ve got now, it’s just the small topics like that St Kilda one’ (Interview, Study 2).

Another illustration of the use of the most quickly accessed resource comes from Paul (Interview, Study 3), who looked up ‘hydrotherapy’ in *Wikipedia* ‘because the dictionary’s much further away than *Wikipedia*’. When he could not readily find a relevant quotation, Lionel postponed the task: ‘Yeah, look, this isn’t going to be all that easy, so I think I’m just not going to, I’ll worry about it later’ (Think-Aloud, Study 3). Students used the resources that they could retrieve readily, and suspended, or perhaps even abandoned, their search when relevant information could not be found in a short time. Lionel, however, likely wanted to demonstrate to the researcher a wide range of strategies and felt obliged to move on to his next sub-task. A similar motivation was seen in the case of Sophie, who indicated that she did not want to spend too much time on such activities as reading a whole article because ‘I wanted to have, to be useful for the thing [voice recorder / research project], so I wanted to, um, show, like, I probably would’ve spent longer on some of the websites, but because I wanted to have, like, show how I’d found different things’ (Interview, Study 3). Lionel would possibly have persisted in his search for relevant information had it not been for my data collection.

There is a hint in Kelvin’s journal that *Google* and *Wikipedia* had monopolised his attention; after expressing a wish that there were alternatives to the two popular resources that did not involve ‘clicking on five different links and going through three different searches’, but that were easily accessible via the school’s intranet, he mused that ‘there may already be such links or instructions and I just haven’t looked for them because I was too busy on google and wikipedia’ (Journal, Study 1). As it happened, the types of resource that Kelvin referred to were available but the multiple clicking that he anticipated was required to access them.

Awareness of and use of prior knowledge is also a pragmatic strategy. Emily (Interview, Study 2) said, referring to the process she used to select her topic, ‘I had a look through them and I saw Dada and surrealism and we’d only done a bit on that in Art […], so I put those together and then that’s how I decided what I was doing’; later she added, ‘I probably did a bit more research on surrealism, ’cause it was a bit easier to find, there wasn’t quite as much

stuff on Dada'. Emily's latter comment is linked to the pragmatic use of what can be readily found, indicating the convenient finding of relevance in what is at hand. Emily found summaries offered by Web pages easier to read than a book she had obtained:

> […] with the Web pages they had a bit more of a summary, which is easier to read. It took me quite a while to read through the book, which I didn't really have time to, 'cause the presentation was due so, yeah, I really only had time to look through the book, sort of gloss over bits.

In Section 4.2.1, I outlined the tendency of participants to select the first result, or those results listed early in a list of results, and to not move beyond the first page to examine other results. Their dependence on clues to relevance provided by an information system is a convenient strategy and undoubtedly saves time. If based on a perception, developed from prior experiences, that results beyond the first page become increasingly irrelevant, perhaps personal experience has motivated such dependence. Whether the phenomenon is explained by system dependence or prior experience, or both, the strategy adopted by participants is a convenient rule of thumb adopted in their searches for relevant information.

Occasionally, participants were unaware of the bases for their decisions; the use of an intuitive response to information, which may be difficult to distinguish from a lack of metacognitive awareness of one's thinking processes, appears pragmatic. A few participants were not able to offer reasons for their relevance or reliability judgements. Chloe, for example, said, 'I don't really know how I [decided], I just thought things that were relevant […] I just looked at it and in my su-, brain maybe […] just decided that must be relevant and that's not relevant' (Interview, Study 2). Elizabeth, in relation to her reliability judgements, seemed awkward and embarrassed when she said that she selected 'just things that seem sort of credible, I guess, I dunno' (Interview, Study 2). A similar awkwardness and embarrassmentwas seen in Kristian when probed for the basis of a relevance decision: 'I don't know [*uncomfortable laugh*], I just decide, um, […] it just happens, I don't really deliberately do it' (Interview, Study 2). Victoria's answer to a question about what made her decide that a particular piece of information was relevant, said, 'Umm … [*3-second pause*] I don' know, I think, [*2-second pause*] I dunno' (Interview, Study 3). The rejection of an information source sometimes appeared to be intuitive, or to entail a visceral reaction. Approaching the *WikiAnswers* website with suspicion based on her previous experiences with this resource

(‘not great, but I’ll have a look, sometimes they do well’; Think-Aloud, Study 3), Chloe is apparently not conscious of her criteria for rejecting the second answer provided on the site. She is, however, clearly offended by references to ‘mother England’; her affective reaction is sufficient to lead her to conclude that the answers provided are becoming progressively worse. Such reactions, although intuitive, may be based on prior experience with the information provided by a particular resource. Participants were not always able to offer a reasoned explanation for their relevance and reliability decisions and appear to have found it convenient sometimes to depend on their intuitive responses. Intuition may, of course, reflect the automaticity associated with experiential wisdom that has developed over several years of interaction with information.

When searching for information related to their needs to complete information search tasks, participants adopted strategies that would find the required information in as short a time as possible. Reliance on results returned by *Google*, particularly the order of those results, was expedient, and the success of such a strategy was rewarding for students. Their practical strategy of adopting the scaffolding effect provided by a *Wikipedia* article, but then attempting to conceal such a strategy from teachers, was pragmatic in the school environment.

Convenient access to *Google* and *Wikipedia*, along with students’ comfort and familiarity with these resources, combined to reinforce their use, and consolidate their trust in them to provide information to use in products that met with the approval of their teachers. Concealment from teachers of part of the genesis of the information was standard practice, a practice based on perceptions of teachers’ reliability judgements.

4.4.3 Theme 3: Relevance priming

The aim of this section is to revisit briefly the post-access relevance judgement of relevance priming presented in Section 4.2.3.1. Here I attempt to reflect on that relevance judgement as a theme that emerges from the results of my study. Relevance priming is one of three process-oriented themes, with the others being relevance chaining and knowledge building. (Data extracts relating to relevance priming appear in Appendix 4.5. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

The main action in relevance priming is the finding of an introduction to, or an overview of, a topic. Students were motivated to find a source that was relevant to their purpose of developing background knowledge in their topic and thus were strongly attracted to those sources that offered information in the form of an outline of their chosen topic. Amber was cited above referring to a source as 'really good because it has information in general on everything' (Interview, Study 2). Brian (Journal, Study 1) wrote of a *Wikipedia* article offering a 'good first overview'. Charlotte spoke of starting her task by finding out about the background to Germany in the 1930s so that she was not 'completely clueless'. Chloe, Paul and Victoria (cited above) used the same phrase to describe what *Wikipedia* articles offered them: a 'general idea' of their topics.

The primacy of the information was emphasised in such phrases and clauses, quoted in Section 4.2.3.1, as the following: 'I generally start with *Wiki*' (Appendix 4.5, A.28); 'a starting reference point' (Appendix 4.5, A.35); 'it just starts me off' (Mark, Interview, Study 2, l. 369); and 'good place to start' (Appendix 4.5, A.33). Use of an overview, such as that gained from a *Wikipedia* article, functions as an advance organiser, sensitising the information seeker to key terms and concepts that appear in information resources accessed subsequently. To that extent, an overview is important in priming the seeker's attention to what is relevant. In knowledge building, a theme considered below, there are successive layers of primacy, that is, one layer of information acts as the primer for the next layer.

Participants, in their quest for an introduction to their topics, looked for an initial framework on which to build their knowledge, in the same way that a gardener may select a trellis on

which to grow a vine, except that participants felt constrained to hide evidence of the *Wikipedia* trellis. When participants had little or no background knowledge in a particular subject area, they were strongly driven to find introductory information first, before embarking on the process of relevance chaining, which is the focus of the next section.

4.4.4 Theme 4: Relevance chaining

This section recalls an aspect of relevance judgements in Section 4.2.3.2 above, namely chaining, in order here to relate that result to a corresponding theme. Relevance chaining is the process-oriented behaviour that occurs when a participant builds on prior knowledge, generally after first having developed an overview, and then finding subsequent sources that relate to the framework that he or she has built from that overview. (Data extracts relating to relevance chaining appear in Appendix 4.6. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

Relevance chaining refers to the way in which one piece of information is linked to the next as a result of their mutual relevance. The phenomenon is a fusion of relevance and reliability in that both the relevance of the second piece of information is primed by the content of the first piece of information, and the reliability of the second piece of information is established, in a process of corroboration, by parts of information that are a repetition of those found in the first. Information in *Wikipedia* was often deemed to be provisionally correct until confirmed by subsequent, corroborating information. While basing one's knowledge building on a source in which one does not have full confidence appears to be building on a shaky foundation, that shaky foundation is likely to be discarded in the absence of corroborating information. Judgements of the reliability of information in *Wikipedia* are held in abeyance but correspondences observed between that information and a subsequent source confer reliability on both. The *Wikipedia* information has a feed-forward effect that is simultaneous with the feedback effect of the subsequent source.

Prime information, that in a general, summarised or introductory form, was not the only way in which participants built background knowledge. Some students reported that what they had learned at school influenced their selection of topic. This generally took the form of students

wanting to extend their knowledge by, for example, learning more about a topic raised in class. During seminars presented by her student colleagues when her class had studied the Second World War, Karen had learned about the disorganised state of the Russian air force, and wanted to know what had contributed to this, and how the situation had improved for the Russians. Emily's interest in Art played a part in her selection of Dadaism and surrealism as topics to investigate from a historical perspective for a History assignment. Victoria had recently completed a presentation on Roosevelt and decided to delve into more detail about why atomic bombs were dropped on Hiroshima and Nagasaki. The building of knowledge here clearly overlaps with relevance chaining and knowledge building, which are two themes considered below. Despite students occasionally having background knowledge, developed prior to undertaking their tasks, they were nevertheless attracted to overview information in order to obtain a map of the territory that they needed to cover, and to consolidate any existing knowledge: 'I'm going to choose Beethoven because I know something about him, but not much, so we'll first learn about Beethoven from *Wikipedia*' (Paul, Think-Aloud, Study 3).

Where a participant considered his or her prior knowledge in a topic area to be severely lacking, he or she would avoid selecting such a topic and, where possible, select one that was not totally unfamiliar. For Rachel, the abundance of information on a topic would have not been sufficient to persuade her to pursue that topic; recognising a lack of prime information in her store of prior knowledge, and unwilling to develop such prime information, she said, 'The Cold War topics, I didn't want to do any of them, even if they had information, because we hadn't done anything in class on that' (Interview, Study 2). Paul, when he had prior knowledge about a topic area, used printed books; when he had no prior knowledge, he used *Google*. Perhaps relevance judgements are more difficult to make with printed books; however, it is more likely that understanding the content of a book is easier with the outline or overview type of knowledge developed from Internet sources. This suggests either that students do not use introductions to printed books for a similar purpose, or that introductions are not deemed to be written in an accessible and appropriately summarised manner. It may also suggest that searching for a relevant book is more difficult without the background knowledge that past generations of students may have gained from a print encyclopaedia. Chloe's experience, however, did not support that suggestion. Chloe had come to the research situation with a strong background in her topic area. Her approach was to complete her book-based research before considering online resources. This may explain why she felt

that, in the less organised world of information on the Internet, relevance was not quite as immediate or as strong. Chloe's experience suggested that information that was easy to access facilitated relevance judgements: 'with the books I was finding what I wanted when I wanted it' (Interview, Study 2). Recall of prior knowledge, whatever its source, must occur for relevance chaining to take place, thereby facilitating knowledge building.

While gathering information, participants used their prior knowledge to detect similarities between what they already knew and the information that they were reading. A key data segment showing the role of the participant's prior knowledge in sensitising her to the information found, thus underlying her relevance judgement, comes from Sophie (Think-Aloud, Study 3), who was able to narrow 'American-educated', in the source she was reading, to 'Princeton-educated':

> [*Reading*] 'He's very similar to his main character, being Pakistani but living in America', and that's really important […] so I'll write that down … might just use dot points for the moment. [*Resumes reading*] 'Mohsin Hamid much like his character Changez is Pakistani-born but American-educated', Princeton-educated actually, pretty sure.

The information Sophie found was important enough to write down and showed that the similarity between the author's life and the life of his main character was a major focus of what she wanted to convey when demonstrating her understanding of the book she was studying. Prior knowledge may have been drawn from long-term memory, as in examples given above of topic areas studied at school, or as in knowledge developed informally; it may have also been drawn from short-term memory, as in cases where students had read an overview of their topic area minutes before, and then begun to read another source that related to their topic.

The following section addresses some specific aspects of how students built knowledge. Their building of knowledge was predicated on the relevance priming and relevance chaining activities described above.

4.4.5 Theme 5: Knowledge building

The building of knowledge theme is not intended to be discrete; it suffused the entire ISP of students. Some students' building of knowledge began before receiving the information search task; for many students, knowledge building began when they located an overview of their intended topic. Knowledge building, therefore, is not a phenomenon that occurred after relevance priming and relevance chaining, but simultaneously with those process-oriented themes. Participants' knowledge building took three major forms: filtering information, matching information, and adding information. (Data extracts relating to knowledge building appear in Appendix 4.7. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

4.4.5.1 Filtering

While the perceiver filters most information, and judgements of relevance and reliability are major *filtering* behaviours, my study has identified some other specific actions by participants to filter information. Shown in Figure 4.10, these include: employing metadata clues to relevance and reliability; examining first sentences, first paragraphs, and other structural clues, particularly headings; assessing writing style and depth of topic treatment; responding to design features; considering the reputation of the source; and the obvious matching of information against topic. These behaviours were outlined in Sections 4.2 and 4.3. Many of these actions occur during both relevance priming and relevance chaining, as suggested in Figure 4.8; I have treated the theme of knowledge building separately for the sake of explanatory clarity, not because of conceptual distinctiveness.

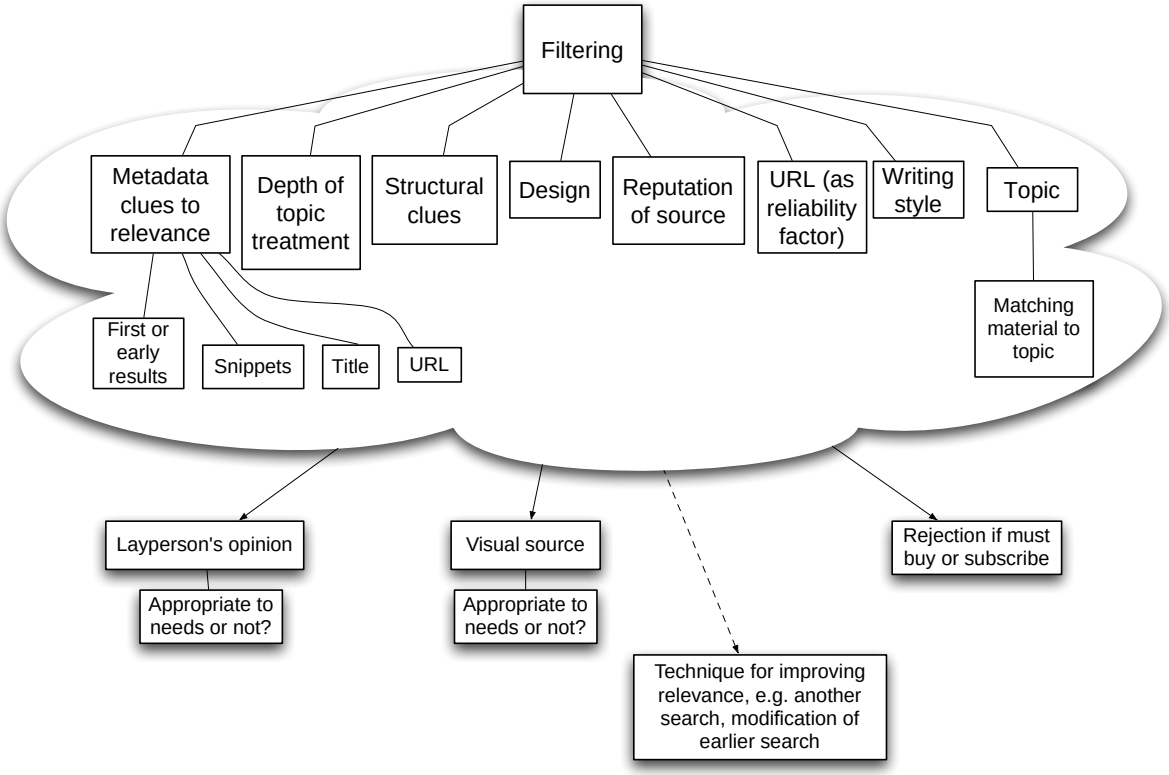


Figure 4.10: Filtering

The actions of participants to filter information are a mixture of their application of relevance criteria and reliability criteria. It appears that decisions about relevance and reliability are intertwined in the act of filtering. Filtering was evident at four points in the ISP:

- when students were assessing results returned by a search engine;
- when they were looking at a selected website or scanning a book;
- when they were taking notes; and
- when they were deciding what to include in their final presentation to meet task requirements.

Relevance was applied as a first-level criterion, that is, once information was judged irrelevant, the application of any test of reliability, a second-level criterion, was unnecessary. Filtering behaviour was demonstrated in the relevance chaining behaviour of participants in their recursive searching; for example, when they searched for a specific piece of information, based on something they had shortly before read, and that they wanted to explore further.

Only a few students (Brian, Gerard, Karen, and, to some extent, Mark) demonstrated filtering by modifying a search string, suggesting that advanced searching techniques were uncommon and that, rather than modify an earlier search query, participants were more likely to undertake a new, though related, search. (Data extracts related to filtering may be found in Appendix 4.7, column A. See, for example, Karen's attempt to broaden her search at A.22. Note that the data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

Students filtered out what they judged to be irrelevant material and they progressively sharpened their focus on what they regarded as relevant. This process included the following behaviours:

- selecting material that answered their information search questions;
- ordering points of information to determine which were relatively more important than others;
- making a narrower selection from information that they had already selected;
- using technology to assist them to determine relevance; and
- reading more broadly than the topic required so that they could then make a selection from their readings that was focused more closely on their needs.

Comments that indicate filtering of a general nature are exemplified in the following: '[I] got rid of anything that was completely irrelevant' (Kristian; Interview, Study 2); 'You don't need all that, all that stuff' (Michael; Interview, Study 2); and the following from Richard (Interview, Study 2), which incidentally also indicates the problem of contradictory information:

> It seems that a lot of the information that's out there on the Internet seems to be rather vague and there's not really a good way to get to what you want to do because everything either says a different thing, like different numbers or facts or things, or they say completely different things and things that aren't really relevant.

At the same time that Mary-Ann was noting which sources offered information on greenhouses, she was eliminating those about the greenhouse effect. Furthermore, from the sources about greenhouses, she was selecting those that appeared to be most relevant. Two processes, thus, operated simultaneously: the separation of relevant from irrelevant; and the separation, in the emerging separated set of relevant items, of 'potentially useful relevant' from 'less likely to be usefully relevant'. Chloe looked for 'just key sort of things that stick out that I haven't really heard before' (Interview, Study 3). Her strategy also gave her a focus for her reading: she was sorting familiar from unfamiliar information as she read. Like Chloe, Mary-Ann separated new from old information: she scanned for 'a few little chunks that … I didn't know already' (Interview, Study 3). For example, Mary-Ann recognised as new information that hotboxes were forerunners of greenhouses. The recognition of new information is important in knowledge building to fill gaps in existing knowledge; in Mary-Ann's words, the new information is 'little bits … that you can just add into it afterwards' (*ibid.*). The data suggest a relevance-irrelevance continuum in which a filtering process occurs: at one end, familiar information is regarded as irrelevant, because it does not require consideration; and, at the other, unfamiliar information is potentially relevant, to the degree that it must be examined in order to decide whether it is connected with earlier information that has been judged to be relevant. The connection with matching, detailed in Section 4.4.5.2, is clear.

During interviews in Study 2, four students related how they responded to search engine results. Talking of what she does with the snippets, the 'little summaries underneath the [website] titles', Charlotte said that she reads them and then 'I look at the ones that I think are going to be the most relevant'. Richard said, 'Firstly I just went to *Google* and just Googled "Anzac Day fraud" to see if there's anything up [?if anything came up] and surprisingly there wasn't really anything'. Chloe 'sort of typed in "what makes a great Australian" – that didn't come up with much', and Mark 'put in the whole question … and it was a bit long and like it didn't come up with much … so I had to change it to just "the Bodyline series" '. At this point in their ISP, students adopted an almost binary approach in judgements of relevance that they made about information that they retrieved: something relevant versus nothing relevant; good versus not good; much that is relevant versus not much that is relevant. At most junctures in their ISP, however, students viewed relevance as non-binary, treating relevance as a continuum. This parallels the hierarchy of reliability, referred to above, indicating that reliability is also perceived as a continuum.

Following are examples of students who, during interviews in Study 2, described their filtering of information when they were dealing with specific websites or printed books. When deciding whether a particular book met her needs, Emily 'had a look, I had a flick through it and it looked good'. Sophie's response to a website was that 'it didn't have much information, most of it, was, you know about the Australian identity. I was a bit interested in that but not [much] and they didn't really explain things, they just generalised a bit'. Chloe found that 'one of the sites came up with schools stuff, like kids doing school assignments so I had a little look at that, like, [and took the] good things about that out'. Victoria's approach to a book was to skim-read a selected chapter and 'if … there was nothing in it then I'd sort of get rid of it'. In an interview in Study 3, Chloe, filtering out irrelevant information, spoke of 'just quick scan-reading, 'cause I'm not doing the Battle of Malay, and I've got a lot on preparations, don't really need to know about Japanese landing, that sort of stuff, so I just went through it' (Chloe, Interview, Study 3).

Decisions about relevance were also made when students were taking notes. Two students who indicated that this was happening at the note-taking stage were Michael ('you can't just copy and paste the whole thing, you need to analyse which parts you need of it and which is actually relevant to the topic'; Interview, Study 2) and Karen ('a lot of the time I just read it and then go, OK, I need to take notes on this, or I don't, and then I'll go and find another website'; Interview, Study 2). The taking of notes entailed filtering, but also adding; note taking is thus considered in Section 4.4.5.3.

Victoria related her experience of filtering irrelevant information from relevant information at a later stage than note-taking, that of deciding what to include in the final product: 'I got quite a lot of books with piles of information in them and so I just stuck it all in and then I had to go through and get rid of it all 'cause it didn't fit or I didn't like that actually' (Interview, Study 2). Another student, referring to her reading about the Gold Rush era in Australian history, was aware that such filtering would need to occur later in her ISP: 'I read a lot of stuff, I just kept reading, like the books, I read through the whole book […] and so I knew quite a lot, even if I knew I couldn't use it, I knew it' (Sophie, Interview, Study 2). Other students, such as Daniel, were also slightly irritated at having to exclude information: 'I have to look at stuff that won't be as relevant to the question and then I have to try and cut out the least important thing. [… I feel] frustrated [*laughs*] because I've got to get rid of an idea that I thought, initially, was quite good' (Interview, Study 1). Again, there is an element of adding in the

foregoing actions of participants; even though the latter examples appear to reflect subtracting, they are actions that occurred in the context of students' decisions about what should be added to, or remain in, their final products.

I noted one example in the data of details that may be irrelevant to the searcher's immediate needs nevertheless being potentially useful at some future point. While searching for biographical details about Beethoven, Paul noted links in the information to Schubert and Liszt; although irrelevant to his focus, he noted them for future reference with the expressed intention that, if he were unable to find enough information on Beethoven directly, he would explore the connections these two composers had with Beethoven. Instead of discarding such information as irrelevant, Paul recognised its potential to become relevant in another context, that is, the condition of not finding sufficient information directly related to his current focus. This underlines the fluid nature of relevance, that information has no relevance in itself but only in the interaction with the needs of the information searcher.

The search terms chosen by participants act as limiters, or filters, to the set of information sources that the information seeker will subsequently consider. Search terms reflect the substance of the search topic, as outlined in the task set by the teacher, but are a representation of the topic, or part of that topic, rather than the topic itself. At times there will be a very close correspondence between the set topic and the search terms; at other times, the relation may be to only one aspect of the topic. Given the tendency of participants to judge relevance as the correspondence between search terms and retrieved results, it should be noted that search terms reflect a participant's interpretation of the requirements of the topic, and that relevance judgements are made by judging the correspondence between the retrieved results and the search terms, rather than between the topic and the results. In that sense, the search terms used by the participant mediate the set topic and the results retrieved. The set topic triggers a priming effect, first by affecting the participant's selection of a search string, then by sensitising the participant to look for keywords in at least four places that accord with those in the search string: in the titles of search results, in the snippets (extracts), in the headings of information sources, and in the text within the information source.

This section has outlined behaviours of participants to sort information into categories of relevant and irrelevant. Rather than a binary dichotomy, participants generally categorised information along a relevant-irrelevant continuum. Filtering behaviours are complemented by several of those described in Sections 4.2 and 4.3. Filtering also occurs as part of the process of matching, which is the focus of the section that follows.

4.4.5.2 Matching

Matching behaviour was evident in two aspects: matching found information to the topic, as far as the participant's understanding of it had developed to that point; and the outcome of this which surfaced as either a match or non-match between found information and prior knowledge. A match had the effect of corroborating the former information, although corroboration may not necessarily have been the intention of the participant. Participants often seemed, rather, to use such information to confirm that the point was an important one. (Data extracts related to matching behaviour may be found in Appendix 4.7, Column B. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

Relevant material was that which answered participants' information search questions. Having chosen their topic within the framework of the task, students had particular questions arising from their topics. These questions may not have always been explicitly articulated but implicitly guided the students' judgements about what was relevant or not. Kristian consulted the question on the task sheet and compared it to notes he had in a Word document 'to see if it would be an answer to the question' (Interview, Study 2). Michael also employed reference to the question to test relevance: 'you only look for, like, linking, like, you know, relevance to it at all' (Interview, Study 2). A decision about relevance is needed at the point of note taking: 'I would just write down anything that I felt related to the topic that I was doing' (Jake, Interview, Study 2). When asked about how she decided whether a point was important or not, Charlotte replied, 'I relate it back to the question that I have to ask, that I have to answer' (Interview, Study 2). Despite correcting herself, Charlotte may have been showing an awareness that she had both to ask questions and answer them: to answer the information search topic, she must pose questions, in the sense of interrogating the information sources.

Connection with the question was Mark's criterion for relevance: 'I did the question "What was the Bodyline series and why was it, um, and was it the wrong time to be having a conflict between the two countries?" and so I just went to them and, um, went to those questions and like answered them'.

In some instances, an entire resource had maximal matching with the student's topic. For Sophie, finding a whole book relevant to her topic was very convenient: 'like a book with, see this one here, *How Gold Shaped Australia*, that's pretty much the question that I'm doing, so there's a whole book with the information that I specifically need' (Interview, Study 2). Amber also experienced the convenience of a single, relevant resource: 'this book was like entirely about it, so it had a lot of information about it, made it easier instead of having to go to lots of different things' (Interview, Study 2).

Judgements of relevance entailed a process of matching search terms and retrieved results to find the degree of correspondence between the two. The process of matching was seen in participants' consideration of the density of search terms in snippets, and the finding of keywords in context (such as searching for a keyword in a retrieved document using the Edit-Find function of the browser). A related process of matching, new with old information, also occurred. Paul found a match between knowledge gained while studying the theory of music and information offered by a website, thus bolstering his confidence in the accuracy of the site. In this related process, the participant brought to his or her awareness old information from memory that was deemed relevant to the current search, and matched it against the new information under consideration in a sorting of known, relevant information from information that had been newly perceived as relevant. It was during this process that participants noted either the corroborating influence of matching information or contradictory information.

If a resource contained information that related to a student's topic, that information was regarded as relevant. It appears that relevance was an overriding criterion, in the sense that relevance may have been enough to seduce the student to use it, perhaps even blinding them to the need to consider its reliability. Amber encapsulates this in her definition of relevant information as 'information that I can use', and is summed up in Michael's use of 'linking' to the topic as being synonymous with relevance. The detection of a relationship between the student's topic and the information under consideration is closely connected with sorting

pieces of information into an order that will establish the relative importance of those pieces, which Sophie and Daniel reported (see Section 4.4.5.1). Matching cannot be easily separated from filtering. It does, however, appear that filtering and matching need to take place before the process of adding, the subject of the following section.

4.4.5.3 Adding

Adding took place when participants decided that the information was of sufficient importance that it should be recorded for possible inclusion in their final product, such as essay or an oral presentation. Adding provides clear evidence that the student has engaged with the material and that he or she has reached some intermediate stage in the processing, or assimilation, of the found information. (Data extracts related to adding behaviour may be found in Appendix 4.7, column C. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

When students took notes, they demonstrated that they believed that the noted pieces of information were worthy to use in their final product, even though they may later have had to make a narrower selection from what they had noted. The role of adding in knowledge building, through memory, is acknowledged by Amber (Interview, Study 2):

> I read it and then I, like, went to, like, think of what I wanted to put in my essay and I couldn't really remember the sort of stuff that was in the book, so I wrote it down so that I could remember it, and wrote it down just to get notes down what was important in the book, and what pages, so that I could go back to them. … I just sort of wrote down stuff about, like, particular points that I needed to know and that sort of stuff.

Brian preferred to depend on his memory of what he had read and to take notes later, saying, 'If I'm writing the notes while I'm looking at it, I end up just writing exactly the same thing, and by relying on my memory I kind of rewrite it in my words' (Interview, Study 1). Charlotte adopted a similar approach. Likewise, Kelvin and Paul, respectively, relied on their

memories: ‘just kind of reading as much information as I could […] and just kind of trying to learn things then write it out in my own words from that stuff I’ve learned’ (Interview, Study 1); and ‘Most of it’s from memory ’cause I’ve read the information quite well and I cite it and it just helps to not plagiarise things when you put it more into your words’ (Interview, Study 3). Several students cited the need to avoid plagiarism by using their own words, and recalling main points from memory.

Oddly, Chloe appeared to note irrelevant information, but, in fact, meant ‘less relevant’: ‘in my book I drew up a table of like important and not relevant and just wrote all the information down in like dot points of what the book said’ (Interview, Study 2). In a similar approach, the taking of notes was an opportunity for Karen to sort relevant from irrelevant: ‘I just read it and then go, “OK, I need to take notes on this or I don’t” ’ (Interview, Study 2). Kathy drew up a table to compare Paris Hilton and Marilyn Monroe against three characteristics and used this device to sort her information, thus maintaining a focus on what was relevant to her needs; she was later able to write a paragraph on each of the three characteristics. Kristian (Interview, Study 2) used columns to organise relevant information:

> I just had information, like all the information that I would need, then after that I kind of put it into dot points of each of the different impacts, like economic and social and cultural and stuff, then after that I sort of just put it into the first draft that I gave to [*teacher’s name*].

Richard (Interview, Study 2) recognised that a benefit of organising his material as he gathered it, as Chloe, Kathy and Kristian did, was that it provided a suitable structure for his final product:

> The main one [advantage] is it’s easy to follow, it’s all set out in a nice way, you can just say, all right, I need to find out, for this paragraph, what was Anzac Day, you can look there, see what you’ve written and put it in. Also, it means it’s less likely to seem like it’s been plagiarised or anything because it’s been written in your own words and then you’re writing it again from your own words into your own words again.

Like the foregoing students, Sophie imposed a structure on material while she was collecting it: 'I'll put it under subheadings, like, um, Soviets, um, evidence suggesting they were not aggressive and expansionist and, um, then, um, the US, were the aggressors, um, responsible for tensions' (Think-Aloud, Study 3).

Jake's approach was to use printed books 'and once I wrote down all the information I got from there […] then, if there're any gaps, then I'd look it up on the Internet and then check it with another site'; he identified gaps in his information so that he would provide sufficient relevant information in his final product. He recognised as relevant information that 'related to the topic' and was 'a big point': 'I would just write down anything that I felt related to the topic that I was doing and was actually something that I needed to write down and would remember, like a big point' (Interview, Study 2).

Having gathered information that was relevant, participants sought to incorporate it in their final products in such a way that the relevance of those products would be evident to their audiences. Relevance was a prized characteristic of final products and, having been discerners of relevance in found information, participants wished to imbue their creations with relevance. Adding was the ultimate confirmation of the participant's belief that the information was relevant.

4.4.5.4 Conclusion to theme of knowledge building

Knowledge building is evident in the three sometimes indistinguishable acts of filtering, matching, and adding. Participants used various criteria to filter and match information that they had found before considering it suitable for incorporation into their information product, presented as an essay or an oral presentation in the current study. Students combined their found information in a unique way to demonstrate their understanding of the topic under investigation; the method of recombining was not necessarily unique, but the selection of which information to combine was.

4.5 Chapter conclusion

This chapter has reported the findings of my study in relation to relevance and reliability criteria applied by a group of secondary school students in Australia. Relevance and reliability judgements, respectively, were made both before and after participants had accessed information sources. Judgements of relevance and reliability were not unitary actions: they occurred in the socio-academic context in which students undertook information search tasks, and also in the context of students' desire to adopt the most convenient and pragmatic approach that would complete the task and achieve an acceptable outcome. Relevance and reliability judgements were also made in the context of seeking a prime source, and finding information that linked to the prime source, as participants built knowledge.

Two critical actions in knowledge building were identified as *relevance priming* and *relevance chaining*. In *relevance priming*, participants sought a brief overview or basic outline of the topic area that became critical in the building of new knowledge; it primed the information seeker in a way that sensitised him or her to particular pieces of information. These particular pieces of information were noted in the second critical action, *relevance chaining*, when the information seeker noted similarities between the information under current consideration and information noted formerly. The prior knowledge used in relevance chaining, and which was developed as part of relevance priming, was most commonly based on one source that provided key information about the topic that the student was investigating. The recognition of new information in subsequent sources was important in knowledge building to fill gaps in existing knowledge.

Primacy of position influenced decisions about relevance, with the first result in the list making it the most likely to be considered first. The criterion applied was that the first result is most likely to contain the highest density of keywords used in the seeker's search string, thereby trusting the relevance ranking of the search engine. Relevance was sought in the results of the first page of a *Google* search, both because participants considered relevance to decline after that and found it too time-consuming to go further into the retrieved results. Other factors provided by the information system included extracts, titles and URLs of online resources.

Initial judgements of an item's relevance, which depended on somewhat more subjective assessments than what an information system, in the form of *Google*, offered, were:

- how well the student understood the material;
- whether the complete source was offered;
- whether the item needed to be purchased;
- whether video sources were appropriate; and
- whether factual or opinionative material was needed.

When participants had begun to examine a source in greater detail, rather than depending, say, on representational data about the source, they gave priority to information that provided topic overviews; to information that linked to prior knowledge: and to sources that treated topics in acceptable depth, and which were structured in ways that enhanced the accessibility of the information.

Students derived clues about an item's reliability from its URL, and took into consideration the reputation of the source. When inspecting the item more closely, the ability of the item to corroborate prior knowledge; its graphic design; the style in which it was written; and the perceived authority of its creators influenced participants' decisions about reliability. Judgements of reliability seemed to be secondary; that is, if a participant had decided that an information source was relevant, tests of reliability were not given a high priority. Reliability judgements, except those related to corroboration, were often based on impressions that appear to have formed during the students' academic careers, rather than on a careful investigation of any one source's reliability.

Most variations in data across the different samples in the three studies relate more to my methodology than to variations in the participants. Most of the feedback about the effectiveness of my data collection tools, for example, came from participants in Study 1 because, as a pilot study, it was at that point that I was most interested in finding out if my techniques were revealing the intended data. Similarly, in Study 1, there was little evidence of intuitive processes used by students for judging reliability; this is explained by the self-report nature of the interviews, journals and questionnaires. Students were unlikely to be aware of their intuitive processes, and thus could not be expected to report on them. However, when an interview question in Study 2 about factors used to judge whether a source was good or not,

and when a video screen capture method, followed by a retrospective interview, were used in Study 3, the investigation tapped their motivation for choosing particular sources, and revealed that some took an intuitive approach. In Study 3, video screen captures offered a richer picture of the way students used technology to determine relevance, an aspect not uncovered in the earlier two studies. In Study 2, data had shown only two students using technology to do this. Similarly, data from Study 3 were more successful at revealing criteria used by participants for the rejection of information than data from the other studies. Thus, variations across the three studies' samples are generally explicable in terms of data collection methods I employed, rather than, say, age or developmental stage of the participants.

The relationship between researcher and participant is an important consideration in qualitative research. As a teacher at the school attended by the participants, I felt gratitude to students for participating, especially the ones in Study 3, who gave up their personal time. One student, Richard (a pseudonym, as for other participants), regularly asked about my progress after he had participated in the investigation. Another student, Paul, when I mentioned my difficulty in recruiting male students and asked whether he had friends who may be interested, generously participated for a second time. In addition, he offered to read and comment on my findings one year after he had taken part; I took him up on his offer and, in an email communication, Paul reported that he had read through my thesis, generously praised it, and 'really couldn't find anything further to add'. I also sent transcripts of interviews to two girls but received no feedback. Such a willingness to share the power to interpret data demonstrated openness between researcher and participants to negotiate the creation of meaning.

I invited students to comment on how teachers and library staff could be of assistance to them in their ISP. Such feedback, used to improve teaching and learning, will have empowered students to contribute to a process of change and improvement.

I also attempted to share influence on data creation with participants. In Study 1, I asked students their views on the effectiveness of the research methods I was using. This offered them an opportunity to influence data collection methods, thereby involving them in the research process. Most students thought the interview method was effective, for example Maria ('I think the easiest way to find out about someone is to ask them kind of thing […] I think it's a good way', Interview, Study 1, ll. 214-215), although one student demonstrated a

quantitative bent when she suggested a survey (Lily, Interview, Study 1, ll. 148-157). Further data extracts in Appendix 3.11 show that the interview method met with widespread approval from participating students.

Like Hall, in Hall and Callery (2001), I found that some interviews contained elements of counselling. Exchanges about the demands of word limits were an example of this, with students being reassured that the frustration of having to cut out material earlier thought to be important was a normal part of the ISP. This simultaneously built empathy when I was able to relate similar experiences. Students also used the interview as a time of reflection on their experiences; Ryan, for example, noted a heightened level of awareness of the process. I feel that most students were comfortable and relaxed when taking part in my investigation. I concluded this from their willingness to ask for clarification when necessary and to indicate when they felt that they did not comprehend the intent of a question. Sophie (Interview, Study 2, ll. 238-240) provides an example of a request for further details in order to answer a question:

> *Interviewer*: What would you say was most influential in developing your assignment?
> *Participant*: [*pause*] um, what do you mean by that? I don't really understand.

Another example of a student feeling sufficiently at ease to query my stated perception comes from Karen (Interview, Study 3, ll. 39 and 51-52), who questioned my impression that she had developed a focus: 'Have I, I don't know, have I found a focus [*laughing*]? … so I haven't really [*laughs*] found, like, what my stance on slavery [her topic area] is going to be'. This suggests that Karen felt comfortable enough to address any misunderstandings she perceived I might have had about her experiences, thus indicating a mutual desire to construct an accurate picture.

I have pondered the possibility of student participants responding in ways that they may have considered would create favourable impressions of themselves. In particular, I have considered whether the apparent affection for printed books was confected as something that may please a middle-aged teacher librarian researcher; perhaps, I supposed, students thought that I would be traditional and have a preference for printed sources, having not grown up with Web resources. I dismissed the notion, however, on the grounds that some students had

genuinely had positive experiences when using printed books (for example, Chloe, who had found a book that she felt was perfectly tailored to her topic) and that so many students seemed to volunteer the information that they considered printed books more reliable, citing the vetting associated with the publishing process as contributing to that reliability. The students knew me as a teacher, however, and so I do not dismiss the possibility that they were responding to me as a member of the teaching profession; because they had noted the beliefs of teachers in general, for example, about reliability (specifically, that *Wikipedia* could not be trusted), they possibly assumed that I shared such beliefs and that it would put them in a favourable light to be seen as agreeing with that position.

Inevitably, my knowledge of the terminology used in descriptions of the ISP in the literature would influence my labelling of data that I felt matched the definitions in the literature. In particular, if I observed a segment of data that looked like what Kuhlthau's (1988) ISP or the NSW Department of Education's (?1989) ISP describes, I would use the terms I knew to label the data. Awareness of these ways of conceptualising data may have limited my ability to identify new phenomena; this is akin to rain falling onto land that already has furrows and tributaries of rivers in it; if rain were data, and the furrows and river tributaries were the conceptual categories, data may have fallen into the categories, limiting the ability for new ones to be created. There is, however, another way of viewing this: existing erosion of the landscape may be considered an image of the current state of knowledge about a field and the researcher may feel obliged to use the existing theory in order to make a productive contribution to that field, unless there are compelling reasons to carve the landscape differently. As Hall and Callery (2001:270) put it, 'theoretical perspectives act to sensitize researchers to particular areas, such as research questions, data collection, and writing up results' but need to be addressed through reflexivity and relationality.

My research work has also had an impact on my view of students as learners, particularly their self-awareness; I was surprised by how keenly aware they were of their learning processes, or the routines that they followed in undertaking information search assignments. While it may be argued that the participants who volunteered to take part represented those students most confident of their learning strategies, and who were most willing to share their articulation of these strategies, I have nevertheless been buoyed by their insights and have a better understanding of students' conceptions of such tasks. This, in turn, gives me confidence to 'unpack' learning strategies, in greater detail than before, with the classes with whom I

work, confident that most students will understand the metalanguage of learning more readily than I had previously thought possible. Though I have made every effort to study the phenomena objectively, far from being unaffected by my research work, I feel its influence on my practice will be long-lasting, considering that it has revealed methods of information evaluation of which I had previously been unaware. In this respect, the study has been a transformative experience for me.

If change is advocated as an outcome of my research, for example, that we teach information evaluation in a way that more closely reflects naturalistic decision making, then I should be explicit that my agenda would be to use this to stimulate closer co-operation between teachers and teacher librarians. My perception of secondary schools, with their divisions along subject lines, is that they are structurally unsuited to teamwork such as that needed with a teacher librarian, and that generic skills (those used across most curriculum areas) are often not taught explicitly, because they are assumed to be taught in other subject areas. A student in a class to which I was outlining my research, for the purpose of recruiting participants, wanted to know what was in my research for him, or students generally, thereby indicating that he expected an outcome that benefited learning. I share with him a desire for there to be some application of my study; I have thus included Section 5.8 below, on the implications of the current research for pedagogy. The use of journaling also helped clarify another aspect of my agenda as the entry below, from my journal, indicates:

> Want to convince educators to work with the way students make decisions about information in naturalistic settings; specifically, to 'chuck out the checklist' of traditional evaluation criteria (as exhorted to by Meola (2004)), which are based on classical decision theory but do not reflect the 'good enough', satisficing behaviour of the information seeker. (Appendix 5.1.2)

In the chapter that follows, I discuss the investigations' findings. Using the five themes identified in the current chapter, I discuss the socio-academic context in which students undertook the information search tasks; the convenient and pragmatic behaviours demonstrated by the participants; and the three interrelated process-based themes of relevance priming, relevance chaining and knowledge building. Knowledge building is discussed through its three features of filtering, matching and adding information.

CHAPTER 5: DISCUSSION

5.1 Introduction

In Chapter 4, I reported the findings of my study with respect to the relevance and reliability criteria employed by a group of thirty-seven students, whose age ranged from 14 to 17 years, in a school in south-eastern Australia. The students were completing information search tasks. The conclusion of the previous chapter offered a summary of the study's findings. In the current chapter, I use the themes identified in that chapter to organise my discussion. These themes are:

- the socio-academic context in which information search tasks were undertaken by students;
- the convenient or pragmatic approach with which they approached such tasks;
- their desire to locate a prime source as an introduction to their topic area (relevance priming);
- their creation of chain-like links to that prime source when searching for subsequent sources (relevance chaining); and
- their other knowledge-building activities of filtering, matching and adding.

A discussion organised along the lines of the five themes above will inevitably introduce a degree of apparent arbitrariness about which findings relate best to which themes. While I have adhered, broadly speaking, to the structure offered in the figures in the previous chapter showing the relationship of the study's findings and its themes (Figures 4.9a and 4.9b), this sometimes runs the risk of oversimplification. An example that has connections to various themes is writing style as a criterion used by participants to judge reliability. I have categorised this as an example of 'Filtering', a node, or sub-theme, of the theme called 'Building knowledge'. When attributes such as author's credentials, and design, are considered, however, these are, I speculate, actually being considered against other sources, most of which remain as traces in long-term memory as impressions. These are essentially subjective, even intuitive, judgements that are based on past experiences of interactions with information sources. Many of these judgements appear to be largely automatic. It becomes evident that filtering on the basis of writing style is, essentially, a way of comparing, and thus

could equally be viewed as part of the node called 'Matching' under the theme of 'Building knowledge'. Such behaviour is also related to the theme 'Convenient or pragmatic approach', because it uses what appears to be an almost intuitive response, which forms part of a heuristic that is employed to assess, quickly and impressionistically, the quality of the information. For further instances of the overlap between themes, see Appendix 5.1.1.

Thus, the five themes are not mutually exclusive. The socio-academic context, as the environment in which students in the present investigation operate, pervades all judgements of relevance and reliability; and an approach to information search tasks that is characterised by convenience and pragmatism can also be expected to suffuse all behaviours of participants. Similarly, almost all data demonstrated knowledge building efforts, thus making the theme of knowledge-building somewhat broad too, encompassing relevance priming, relevance chaining, and the more specific actions of filtering, matching, and adding.

Charmaz (2006:182-183) offers the following criteria for evaluating research in grounded theory studies: credibility, originality, resonance, and usefulness. I have noted, in Table 5.1 below, the indicators through which I believe my investigation fulfils these criteria; the reader must decide, however, whether the study meets the criteria in the ways indicated.

Criterion	**Indicators**
Credibility	Portrays intimate knowledge of aspects of ISP from participants' perspective; provides sufficient data to support claims; systematically compares categories; uncovers a range of observations; links data with argument and analysis; reader is able to make independent assessment, using data presented.
Originality	Provides new categories and concepts; is of theoretical significance; refines and extends current state of knowledge.
Resonance	Covers fullness of phenomena studied; reveals both conscious processes and those of which participants were not consciously aware; makes links with broader context; makes sense to teachers, parents, and students with whom findings have been shared.
Usefulness	Is able to be used in teaching and learning; portrays generic processes; considers implications; stimulates further research; contributes knowledge that may lead to improvements in teaching and learning.

Table 5.1: Claims made of the current study against Charmaz's (2006) criteria

5.2 Socio-academic context

(*Note*: Data extracts relating to the socio-academic context appear in Appendix 4.3. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

The current study identified interactions revelatory of the academic life of students on a teacher-student level and a student-parent/sibling level. Both academic and social factors influenced students' information search tasks. Requirements that students search for and use information are embedded in learning tasks and form part of the school setting. Students had developed routine behaviours in response to such tasks and came to rely on familiar methods that employed information resources with which they were comfortable. Teachers set tasks for students to complete but supported students through assisting in their choice of topics, allowing considerable scope of choice within a broad framework, and giving feedback on drafts of essays written by students. Teachers influenced students' judgements of credibility when they did not reward students' use of information sources that teachers considered unreliable, or when students perceived that this would be a likely outcome of the use of such sources. Given their predominant use of online sources, students faced particular challenges in the modern academic milieu without experience of the cues used to indicate credibility in the print world. Parents and siblings, broadly, provided a context in which students developed interests; such interests, commonly motivating a student's choice of topic, were pursued in the academic sphere. Parents and siblings assisted by commenting on drafts, guiding technical aspects of students' work, and sharing interests that students then pursued when offered the opportunity. The use of the reputation of a source to judge reliability was commonly derived from the views of others in the social and academic spheres of a student's life.

The homogeneity in cultural background of study participants, considered in Section 3.6, allowed social influences and shared goals in the community to be more readily recognised. Teachers' expectations of academic performance, and students' perceptions of these, were reasonably uniform. Participants were able to predict the likely result of the effort put into tasks with some confidence, based on the consistency of their experiences in the socio-academic environment. The role of family members was clearly evident.

In the remainder of this section, I consider other studies that have shed light on the influence of people in the student's community. The social context, in the related literature considered below, is generally seen to exert considerable influence. Developments in the wider society have seen different information formats being made available, with the result that clues to the reliability of information that were applicable in the offline context are of little use in the online setting.

The socio-academic context, in essence, recognises the theme that Williamson and McGregor (2006) refer to as 'people', which includes teachers, teacher librarians, family members, peers, and others (for example, experts). Except for their identification of 'outside' help in the form of specialists, which Williamson and McGregor report was used by one student (but no such example was found in my study), my use of socio-academic context matches their 'people'. While they used their theme in the context of plagiarism, mine applied more broadly to the information search process (ISP) of the student, although its influence in the current study was seen most strongly in relation to topic choice, which, as an early stage in the ISP, influences relevance judgements.

The study of Hargittai, Fullerton, Menchen-Trevino and Thomas (2010) is very relevant to my investigation, given both studies' interest in students' credibility judgements, and has a validating effect on my findings, even though its participants (aged 18 to 19) were older than those in my study. 'Contacting people' in Hargittai *et al*. (2010:484) relates to my socio-academic context theme. While their theme describes 60 per cent of their participants contacting an institution for information, they noted that about one-fifth contacted a friend or a family member. A smaller proportion, only two of the thirty-seven students in my study, relied on information from family members. The Hargittai *et al*. study, however, is noteworthy for positioning trust behaviour in a broader context than simply the immediate search act, by considering antecedents to the evaluation of a specific piece of found information. This broadens the process of behaviour associated with evaluating information. Hargittai *et al*. have shown that credibility judgements begin before a piece of found information is considered, thus showing the role played by the search context, not simply an individual information source in that context. They discuss the role of brand, calling brands recognised by participants 'essential signifiers of quality' for them (2010:481), and cast search engines in the role of gatekeepers in the online environment, corresponding to editors in the traditional print environment. Hargittai *et al*. refer to prior experience, 'name-brand

recognition' (*ibid.*), and routines of search behaviour, indicating how these combine to develop reliance of students on the familiar. The 'brand effect' (2010:486) of a search engine arises from students' dependence on it as a reliable source of relevant information. My findings indicated that relevance is of more concern to students than reliability, considering their dependence on *Wikipedia* information, whose information they find relevant and usable, even though they claim that teachers consider it unreliable. Their regular use of *Google* was positively reinforced through its ease of use and its provision of relevant information sources. The choice of this search engine is explicable in terms of its familiarity, routine search behaviour, and past successful experience using it (achieving satisfactory results when assessed by teachers), a set of related factors that build brand loyalty.

Another investigator who identified a similar theme to my socio-academic context is Westbrook (2006), who elicited the mental models of the academic information seeking process of thirty-four students in a post-graduate reference course, and identified 'people' (family, friends, classmates, faculty, subject experts, and librarians) as one of four components.

Limberg (2007) argues for an integrated focus in research into students' interactions with information for educational purposes: one that focuses both on learning and also on the information seeking and usage behaviour of students. Such interaction with information cannot be divorced from the school's discursive practice; within that context, students define the tasks requiring them to learn from information. My study has revealed such aspects of the discursive practice of the school as: the value placed on printed books, assumed by both students and teachers to possess pre-existing reliability; and the charade surrounding the use of *Wikipedia*, in which students depend heavily on it but are not free to acknowledge that dependence because of their perceptions that teachers consider the encyclopaedia unreliable.

Students may be oversimplifying the message from teachers about the distinctions between print and Internet sources when teachers require that students use sources in print format, or certainly appear to value print more than electronic sources on occasion. Elizabeth, for example, believed that she would be awarded a lower mark for not using books (Appendix 4.3, A.20); and Victoria claimed to rely on a book source if there was a conflict with another source (Appendix 4.3, A.24). How Victoria would have dealt with conflicting information in two printed books is unclear. Participants accorded published books an intrinsic reliability,

a likely effect of socialisation. Printed books, however, were considered by participants to provide an in-depth treatment of a topic, whereas online sources were generally viewed as offering brief information and thus relevance, rather than perceptions of reliability, may have played a more dominant role in explaining actual use. The more depth the source offered, however, the more likely it was considered reliable. Relevance was an overriding criterion and relevance needs varied according to the depth required by a participant in an information source. It was difficult for participants to distinguish between print and electronic sources, as suggested by a blurring between the print and electronic worlds when a student used 'post', in relation to books, to mean 'published': 'It's a lot harder to post rubbish in books' (Chloe, Interview, Study 3).

Hargittai *et al*. (2010:472) refer to the 'intertwined' nature of online and offline life. In my study, this was seen in participants' use of Internet and books, dependence on the reputation of traditional print sources, and the reliability of those sources in the offline world being transferred to their respective online contexts; for example, *Encyclopaedia Britannica*; *Sydney Morning Herald*; and the BBC (British Broadcasting Corporation). Sophie, Charlotte, Emily, Sharon and Victoria trusted *Encyclopaedia Britannica* (see Appendix 4.3: A.16, A.19, A.21, A.32, and A.34) and Edward based his trust in a *Sydney Morning Herald* article on the journalist having spoken to an author of a book on the topic (Interview, Study 3, ll. 215 ff.). Reputation of sources is associated with brand loyalty; the latter develops as a result of dependence, with positive results, over a long term, with the effect that the source comes to be regarded as reputable. While likely that reputation is often based on hearsay evidence, rather than direct experience, the data in the current study did not shed sufficient light on this to be definitive. Stefano, for example, claimed that his trust in the BBC was based on personal experience (Appendix 4.3, A.39).

Hargittai *et al*. (2010) recommends the investigation of motivation to develop a fuller understanding of credibility judgements. My study provides some indicative data on motivation. When students were preparing for tasks that had a lower value in terms of their consequences for student assessment purposes, standards of reliability were lowered. The clearest example in my study was Paul, who was willing to depend on *Wikipedia* when a Science task was not for assessment purposes but would not risk using the encyclopaedia for another Science task that was an assessed piece. Engagement with a topic is linked to

motivation, as are skills to complete a task. Gordon (2009:40) refers to studies (presumably hers, of 1999 and 2000) that found that 'personal engagement with a topic is critical to successful outcomes'. Note also her statement that '… critical thinking skills craft the connection between information and knowledge' (Gordon 2009:40), indicating that competency in evaluating information is necessary in the transformation from found information to personal knowledge.

The socio-academic landscape of the modern student, particularly in relation to information available, differs considerably from that of the student a couple of decades ago. There are fewer clues to the reliability of information in the online world than in the traditional print world. Study participants reported that it was easier to discern reliability when dealing with books (see Appendix 4.3: A.2, A.14, A.18, A.20, A.22, A.28, A37, and A.38); their generalised belief about books was based on the vetting that they perceived to be part of the publishing process. The considerable similarity in the design of websites makes it difficult for students to use appearance to discriminate between reputable sources and unreliable sources. In contrast, a scholarly journal and a popular magazine, in their respective print forms, are readily distinguished. Holliday and Li (2004:356) claim that undergraduate students have scant knowledge of the production, organisation and dissemination of information, having grown up with the Web and developing the expectation that all electronic information can be searched using methods that parallel those used with *Google*. Jenson (2003) suggests that, accustomed to receiving most of their information on a computer screen, tertiary students are not able to distinguish easily between a scholarly journal and a popular periodical, having had little or no experience handling the print versions of these.

Hofer (2004:51) has a similar view: that technology has changed the way students access information; that easy access to Internet resources makes the 'tangible connection to print materials less common'; and that the modern student is less likely to be aware of the distinction between 'magazines' and 'professional journals' without experience of the print versions. Ferguson, Neely and Sullivan (2006:69) found that participants gave lower ratings of usefulness to 'quality research - such as theses, dissertations, and refereed journals' than less scholarly sources of information. Jenson (2003) suggests teaching students the language of both library research and electronic library research. Jenson warns that apparently high levels of computer literacy do not necessarily imply that students have highly developed computer-based research skills. Modern technology has provided an abundance of easily

accessed information; the new information landscape, as part of the socio-academic context of the contemporary student, offers particular tools that, over time, become familiar to students and are resources on which they depend. The most notable among these tools are *Google* and *Wikipedia*, which are discussed in Section 5.3.

Students absorb lessons from their teachers about which sources are reliable and which are not. Walton and Archer (2004:11) found that first-year engineering students at the University of Cape Town did not have 'well-developed academic evaluative frameworks' and consequently were more reliant on sources endorsed by their instructors. The secondary students in my study, in contrast, for the most part, used their own methods of evaluating information; however, they learned what *not* to be seen to trust, specifically *Wikipedia* (for examples, see Appendix 4.3: A.9, A.21, A.26, A.27, A.31, A.33 and A.37). Kelvin and Stefano were exceptions to this general belief; their comments, respectively, were: 'contrary to what most teachers will have me believe, I find the information to be accurate' and 'teachers actually seem to be quite happy with it' (Appendix 4.3: A.11 and A.39). Students assumed a position of compromise when they respected teachers' perceptions of that source's unreliability by not citing, yet appropriating, the introductory framework offered by a typical *Wikipedia* article. In the socio-academic context of the student, an ecologically valid solution was found: one that met information needs but also respected the inferred wishes of assessors. The ecological validity of the solution for the student may equally be considered a convenient, pragmatic solution applied within his or her socio-academic context for the maximum return on effort expended on the task.

Jones, Estell and Alexander (2008) note that research on self-regulated learning has focused on the role of the individual; however, relying on the work of psychologist Albert Bandura, they admit the theoretical possibility that the group also plays a role in self-regulatory behaviour. My identification of the socio-academic context of learning supports this: behaviours learned from the group, having been instilled in the individual, influence self-regulated learning of the type engaged in by the study's participants. Participants strongly believed that teachers were wary about trusting *Wikipedia*; the clear consensus among the group was that it would jeopardise the chance of achieving a good result if traces of the use of the encyclopaedia were left in the product submitted for assessment. The group also appeared to have come to a tacit agreement that it was legitimate to use the encyclopaedia as an introduction from which to launch a fuller investigation of their topic, which was achieved by

examining additional information sources. The use of *Wikipedia* as a source of general, introductory material on a topic is pursued further in Section 5.4.

My discussion of the socio-academic context has covered the influence of teachers on the reliability judgments of students. The relevance of *Wikipedia*'s articles to students' needs, with the role played by the information source in providing a prime source, appear to be sufficient to overcome teachers' perceived objections to the reliability of the encyclopaedia. Students have convinced themselves that they are able to obscure the influence of *Wikipedia* information, achieving that by citing only other sources. There were few, but clear, indications that the value accorded a task in the school setting, evidenced by whether a task was for assessment purposes or not, influenced students' reliability judgements: the more the task 'counted', the more stringent were the reliability criteria applied. Throughout their scholastic careers, students had assimilated opinions about the reliability of particular information sources, and used the reputation of such sources to guide their reliability judgements. Parents and siblings sometimes influenced students' topic choice, which in turn had an effect on relevance judgements when topic choice is considered the beginning of an important early attuning to what is of potential relevance.

5.3 Convenient or pragmatic approach

When undertaking information search tasks, participants in my study found it convenient to rely on their prior experience, part of which had presented opportunities to develop a set of routine behaviours. Such routine behaviours had become almost automatic, if not intuitive, as a result of being practised over the course of students' scholastic lives. Their routine behaviours consisted of a set of heuristics that included relying on the first available results; depending on the search engine's calculations of relevance; and predicting, on the basis of data about resources, which were likely to be most profitable for fuller exploration. They applied such heuristics in their attempts to resolve their uncertainty and to minimise decisional conflict. To the extent that the use of heuristics 'got the job done', these techniques were pragmatic solutions to students' information problems and achieved outcomes acceptable to students and, apparently, also to teachers. The heuristics applied by students, rather than necessarily being employed as a means of coping with information overload, may reflect a natural limitation of resources, such as time and cognitive capacities, to absorb information. What appears to be an approach of convenience or pragmatism may be, with less likelihood of such a label carrying negative connotations, the application of procedural knowledge in a relatively effortless manner. In that sense, the theme of 'convenient or pragmatic approach' refers to a set of heuristics that comes into play when a student undertakes an information search task. (Data extracts relating to a convenient or pragmatic approach appear in Appendix 4.4. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

The remainder of this section makes links between convenience and pragmatism, on the one hand, and a series of related concepts from the literature, including information foraging theory, prospect theory, persuasion, accessibility, and satisficing, on the other. Further discussion of the literature relates to our tendency to reduce inconvenience, uncertainty, and decisional conflict; and to our development of mental models to save time and apply processes more automatically. Also examined are the notions of situated cognition, epistemic deference, and regularities in the ecology of the Web.

Convenient reliance on a known information gateway avoids the risk that exploring an unfamiliar gateway will take time and energy that may prove to be unproductively spent. Information foraging theory assumes that someone looking for information will pursue resources that 'maximize the rate of gain of information relevant to his or her task' (Pirolli & Card 1999:646). Students in my study commonly used resources that required the least effort to access, search, and process by extracting from them information relevant to their tasks. In Pirolli and Card's (1999) terms, they were obtaining a return, in the form of what they regarded as valuable information, for the lowest cost. Students judged whether information was valuable or not; most students found relevant information, they learned from it, and their essays and presentations were generally of a high standard. Following Valenza (2006:20), however, a substantial majority of information seekers seemed to 'stop their searching at good enough'. The students in Shenton and Dixon's (2003a:1041) study, like those in the current investigation, were 'generally intent on retrieving sufficient information to meet the need with the minimum of inconvenience to themselves'. These are not necessarily lamentations that students are not exploring available information sources in depth or exploiting the broadest possible range of resources on offer, but may instead reflect the natural limitations that we all experience when processing information.

The study of thirty-four undergraduates' use of *Google* reported by Joachims, Granka, Pan, Hembrooke, Radlinski and Gay (2007:9) found that 'users clicked substantially more often on the first than on the second link'. I suggest that, motivated by the desire to resolve the uncertainty that stems from lacking knowledge of their selected topic areas, participants in the present study readily and pragmatically appropriated the first result that they perceived as relevant (see Appendix 4.4: C.12, C.19, C.21, C.22, C.31, C.32, C.33, C.34, C.37, C.38, and C.39). Kuhlthau's (1989; 2007) six-stage ISP, described in Section 3.3.2, is one of the best known and enduring models and, essentially, describes the information seeker's move from uncertainty to, generally, certainty, or at least a state of reduced uncertainty. At Kuhlthau's initiation stage, a person will generally feel uncertain and apprehensive but, by the final stage, has moved to a state of less uncertainty. Kuhlthau (2007) speculates that information technology, by giving access to extraordinarily large numbers of information sources, may contribute to increased confusion and uncertainty. I suggest that there is considerable

uncertainty surrounding information search and use, including, to name a few, uncertainty about:

- what search terms to use;
- what results a search will retrieve;
- whether results will be relevant;
- whether information will be sufficient to complete the task;
- whether the information is reliable;
- whether it will be comprehensible; and
- whether information will be able to be integrated into the final product.

Prospect theory may be useful to explain why students use the first available relevant result, rather than undertake a more exhaustive search. ('Prospect' is used here in the standard dictionary sense of 'the possibility or likelihood of some future event occurring' [*New Oxford American Dictionary*].) Support for Pirolli and Card's (1999) information foraging theory, referred to in Sections 1.4 and 2.2, is evident. The sure outcome, represented by the retrieved relevant information, will not be given up for the uncertainty of whether additional time invested in searching will yield a more comprehensive set of relevant information. The investment of additional time is a risky prospect, and the chances are that additional information will be of a very similar relevance value to that already retrieved. Whitmire (2004:101) has associated the selection of the first results from a search engine with pre-reflective thinkers, that is, those that believe that 'there are right and wrong answers and only authorities know the right answers'. I doubt whether pre-reflective thinking explains such behaviour in the current study; I suggest that participants' epistemological reflection and reflective judgement models were more developed than this. Aula and Nordhausen (2006) concluded, from an examination of log file studies, that searchers typically checked only one result page. Jansen and Spink (2006), while reporting the dramatic increase over the years of information seekers viewing only the first page of results, suggest that while this may reflect 'increasing simplicity in interactions', it quite likely also reflects search engines' greatly improved ability to retrieve and to assign relevance rankings to information sources more successfully. Considering that the present study's participants found that the simple strategy of using only the first page of results was effective, they had no cause to develop a more advanced strategy.

Once students have developed a repertoire of strategies to use when undertaking information

search tasks, and these have become somewhat automatic, students recognise the circumstances in which such strategies may again be applied. Soman (2004) provides insights into the framing effect, mental accounting and loss aversion that appear to explain my participants' behaviour. Soman (2004:380) uses 'frame' to describe 'a mental model … of the decision problem that individuals use to solve the problem'. I suggest that the way in which the teacher formulated and presented a task had a framing effect; that is, it had an effect on the way in which students mentally represented the task. Previous experience with *Google* and *Wikipedia* also evoked a framing effect; that is, the problem stimulus of an information search task assigned by a teacher was framed as a task requiring the use of *Google* and *Wikipedia* because of students' prior experiences of success as a result of using these resources. The sort of mental accounting that a student engaged in included calculations of the amount of time available, and the number and type of other academic tasks that had been completed or remained to be completed. One illustration of this comes from Emily: 'It took me quite a while to read through the book, which I didn't really have time to, 'cause the presentation was due so, yeah, I really only had time to look through the book, sort of gloss over bits, so and read bits' (Appendix 4.4, A.21). Michael planned to take the extra time in his next task to use books, although I did not establish whether this came to fruition: 'maybe more book work ... it's a harder way to get it but I think it, the results might work out if you take that time and do it' (Appendix 4.4, A.27). Karen, talking of the time required to absorb information from books, said, 'it's just it takes a while to read it all' (Appendix 4.4, A.22). Stefano applied a rule of thumb in which he rejected very short information sources; although the bibliographies of such sources could be consulted for additional reading, the time needed to do that was a drawback (Appendix 4.4, A.39). Both procedural knowledge, such as ways of approaching the task that have a track record of success, and declarative knowledge, that is, factual knowledge about the topic under investigation, are imbued with a high value, and the time that may be spent to develop new strategies, or to find additional relevant resources, looms large as a potential loss of time. Aversion is to the loss of time, rather than to the information source, which remains in hand; the gamble of spending additional time, on a different source, with the possibility of no further gain than what is in hand, is perceived as not being worth taking. The sunk-cost effect, that is, the 'increased tendency to continue an endeavor because some past investment has been made' (Soman 2004:388), is also operating, in that the greater the time spent on processing the information sources in hand, the less likelihood there is that the student will allow that time to go to waste by being 'distracted' by other sources, on which even more time would need to be expended.

Perhaps information seekers are minimising decisional conflict by restricting themselves to a smaller set of information and preferring the status quo of the initial set of information (LeBoeuf & Shafir 2005). In effect, their choice is not to consider further choices. 'Conflict among options … appears to make people less happy about choosing, as well as less happy with their eventual choices' (LeBoeuf & Shafir 2005:250). Newell, Lagnado and Shanks refer to a series of experiments by Connolly and colleagues that suggested that participants preferred to take a risk with immediate information 'rather than methodically go through all the available information' (2007:32). Students in the current study used the information at hand because it represented an immediate resolution of their uncertainty; to the extent that it was relevant, it was certain, whereas looking for additional information would delay both their completion of the task and a reduction in uncertainty. Participants may be viewed asrisk takers who gamble on the 'in hand' information being adequate to the task; they are possibly avoiding the risk that an examination of additional information may reveal inconsistencies with what they already have. If so, this suggests that they are avoiding the academically demanding task of resolving the dilemma of conflicting information. Teachers designed tasks that required participants in my study to consider multiple sources of information, even if such a requirement was not always made explicit. Without such an expectation, students may have stopped looking for further information after reading the first relevant result. Task design that forces students to confront the possibility of contradictory information is likely to result in richer understanding of topics by students.

The use of multiple sources, which may increase the possibility of encountering conflicting information, has been shown to: deepen students' understanding of content knowledge and to encourage the use of corroboration (Nokes, Dole & Hacker 2007); be more demanding for the student to process than a single text, their use assisting in the building of a lucid mental representation of the topic (Cerdán & Vidal-Abarca 2008); and assist students' understanding of the complexity of the historical event they were investigating (Wolfe & Goldman 2005).

Taraborelli (2008) offers at least three insights that explain some of the pragmatic behaviour seen among participants in my study. Specifically, these are his discussions of situated cognition, epistemic deference, and the strong regularities in the ecology of the Web. His reference to the principle of situated cognition, that 'organisms tend to externalize the solution of demanding cognitive problems to the environment and use the environment as an external

scaffolding to decrease cognitive effort' (2008:198) sheds light on why students in my study deferred to the 'judgement' of the search engine's relevance ranking, agreeing with it when claiming that relevance decreased beyond the first page of results. Taraborelli refers to'epistemic deference', a notion drawn from social epistemology, and which he describes as occurring when someone defers to an external source 'in order to extend her knowledge to facts with which she has no direct acquaintance' (2008:195); this notion appears to explain the apparently pragmatic appropriation of relevant resources, particularly, for example, a resource offering a framework that covers the main points of a topic (see also Section 5.4).

A further insight from Taraborelli relates to the distinct, strong ecological regularities of the Web environment, which he relates to information seekers operating within that environment, and plausibly concludes that they leverage such ecological regularities 'in order to select effective solutions for negotiating source selection problems' (2008:199). I suggest that these solutions form part of the pragmatic heuristics students adopt when choosing relevant and reliable information. In summary, the three insights offered by Taraborelli offer explanations for students' acceptance of the rankings of *Google* results (using the notions of situated cognition and epistemic deference) and the manner in which students have developed patterned behaviour in response to the structured environment of the Web.

Hargittai *et al*. (2010) found a lack of correspondence between claimed behaviour on surveys and actual behaviour in their follow-up study. While interesting for its methodological implications, this suggests the shorthand methods of evaluation of information that students have built up, and from which they draw almost intuitively. In the current study, some students made reliability judgements based on apparently visceral reactions; for example, Kelvin dealt with conflicting information by using a 'gut feeling' about which was right (Appendix 4.4, D.11). Chloe, Kristian, Sharon, and Victoria were unable to articulate their processes for the selection of relevant information (Appendix 4.4: D.15, D.17, D.32, D.34). Elizabeth, similarly, lacked awareness of how she decided on the reliability of information, although she avoided social network sites, preferring 'university sites and stuff, like proper History sites' (Appendix 4.4, D.20). Stefano described going to *Google* as a 'natural instinct' (Appendix 4.4, D.39). The disadvantage of such automatic behaviour is that it is usually beyond the deliberative process of decision making and, by implication, less prone to being modified, considering the lack of conscious control that the individual has over the process. (Section 5.5 refers to the dual systems of decision making.) Hargittai *et al*. (2010:487) suggest

that ‘students are not always turning to the most relevant cues to determine the credibility of online content’. It seems that students’ broad understandings about the style, including depth, with which an author writes indicates to them the author’s credentials; these understandings have probably been generalised by exposure to the work of many authors. Flick (2006:369) warns the researcher that ‘stereotypically repeated’ statements or observations may be indicative of ‘a purposively shaped version of the event rather than as a clue for how it “really” was’; this may explain students’ claims that they were checking the credentials of the author but data did not show that this was happening in practice, suggesting that their shapedversion of what they thought they were doing did not reflect what they were really doing. Students have developed heuristics for judging credentials, rather than painstakingly examining an author’s credentials for each piece of information.

Rieh and Danielson (2007) discuss the notion of persuasion, which has some application to consumers of information. A Web user has two apparently contradictory ‘forces’ to reconcile: first, to reduce the uncertainty which has motivated him or her to seek the information in the first instance, by finding information that resolves that uncertainty; and, second, to be wary of the accuracy of the information claims made by the source, and thus risk the delaying of the resolution of uncertainty. It seems that, on occasion, an information source that is under one’s immediate consideration, and whose relevance one is able to perceive readily, is likely to persuade one to use it. Perhaps that almost automatic and pragmatic reaction will only be prevented through the intervention of the deliberative process of decision making.

While noting a limit to the similarities between the consumer in the commercial context and the consumer of essentially free information, the role of persuasion is worth further consideration. Although a search engine may not be perceived as attempting to sell a product or service in the way that an e-commerce site is, search engines appear to want to build brand loyalty, that is, to provide a service to which the information seeker will return each time to meet an information need. With experience of the offerings of the search engine (returned results), the information seeker learns which results not to regard as persuasive enough to even consider. I have called this set of decisions ‘pre-access’ judgements to indicate that students made them before considering each full source; students had thus employed a set of cues that would persuade them of the likely utility of the source. Participants brought preconceptions about a resource or group of resources to their tasks; for example, Kelvin held the belief that *Wikipedia* was a useful resource: ‘The reason that I prefer to use wikipedia is

because it is so easy to use, and it is usually written in language I can understand' (Appendix 4.4, A.11); websites selling books were unsuitable for Edward (Appendix 4.4, B.35); and, for Sophie, '*Google Books* can be really well, um, really good because, although they don't give you the whole book, they give you tons of books and you can type in, um, the keywords' (Appendix 4.4, B.33). Friestad and Wright (1994:1) describe their Persuasion Knowledge Model as 'a model of how people's persuasion knowledge influences their responses to persuasion attempts'. If we conceptualise a search engine's results as items that persuade the searcher to use them, the searcher must employ his or her knowledge of the persuasive properties (for example, snippets, bolded terms, URL details), built up over time, to decide how to respond. The searcher's interpretation and evaluation of the persuasive properties in each result will influence whether that site will be visited.

Friestad and Wright (1994:2) use 'targets' to refer to 'those people for whom a persuasion attempt is intended', 'agent' for 'whomever a target identifies as being responsible for designing and constructing a persuasion attempt' and 'attempt' to refer to 'a target's perception of an agent's strategic behavior in presenting information designed to influence someone's beliefs, attitudes, decisions, or actions'. When participants in my study rejected results from *eBay* and *Amazon* (for example, Chloe: 'I realised that it was *eBay*, *eBay*'s not going to be any good', Interview, Study 3, l. 360; and 'Ah, *Amazon*, I don't want to have to, I can't buy a book', Think-Aloud, Study 3, ll. 75-76) or when they did not pursue results from *Google Books* (Sophie was an exception to this; see Appendix 4.4, B.33) or sites that offered only abstracts of articles or books (for example, Mary-Ann, Appendix 4.4, B.31), they were using their persuasion knowledge, that is, that these sites did not generally lead to productive outcomes for them. Having developed such knowledge, they were able to employ a short-cut decision process (heuristic) to reject such choices. When this occurred, the agent's attempt had been unsuccessful as the target had rejected the attempt. Persuasion operates not only at the stage of selecting an information source, of course, but continues when the information seeker begins to engage with the information presented in any selected information source.

In Chapter 4, I referred to pre-access judgements of both relevance and reliability (Sections 4.2.1, 4.2.2, and 4.3.1). Taraborelli (2008) categorises reliability judgements as predictive judgements of epistemic reliability, which he considers feature only infrequently in the literature related to the credibility of Web information sources. He describes predictive judgements as those based on information *about* the source, rather than on the source itself,

offering link descriptions as an example of information about the source. Such information, in Taraborelli's (2008:199) opinion, 'becomes much more critical for its evaluation than the actual content it delivers'. I have considered the titles, snippets and URLs on the results page returned by a search engine to be cues to relevance, which are used in a process of forward inferential reasoning; Taraborelli calls these non-reputational cues because they do not offer explicit clues about source credentials, and notes that these are part of the proximal information used by an information seeker to determine which sources may be profitable to choose to investigate.

Taraborelli (2008:198) views the use of predictive judgements as the 'only viable solution' to the constraint of epistemic pollution, a notion closely related to information overload in that a high number of sources are available to the information seeker but they offer 'potentially relevant but weakly authoritative information'; under such conditions, it is impossible to examine each source in its full form, and thus predictive judgements must be made. Reliable heuristics, Taraborelli concludes, must be used for judging the reliability of sources; that is, predictive judgements must be effective in sorting credible from unreliable sources in a time-efficient manner.

Kahneman and Frederick (2005:271) use 'accessibility' to mean 'the ease (or effort) with which particular mental contents come to mind'; the relation of my theme of convenience to their notion of accessibility is evident among participants both in the procedural and declarative knowledge that readily came to the participants' minds. Procedurally, participants easily fell into the routine of using *Google* for online searching and then using a *Wikipedia* article as the basis of their knowledge building (see Appendices 4.4 and 4.5); declaratively, it seemed relatively unchallenging for them to match one piece of remembered information with a piece that they were reading or recalled from earlier reading, and thereby develop new knowledge. Kahneman and Frederick include, among the processes by which accessibility occurs, a selection of concepts from psychology: 'stimulus salience, associative activation, selective attention, specific training, and priming' (2005:271). The first four processes were seen in my data, in such processes as, respectively: the information search task in the socio-academic context having a strong 'likelihood of being noticed and responded to' (Leslie & O'Reilly 1999:83); the task activating associations with past successful uses of *Google* and *Wikipedia*; participants focusing on what in the information was most relevant; and

participants' training to be suspicious of the reliability of *Wikipedia*. Priming is, however, of most interest in the current study, and will be taken up in Section 5.4.

Also aligned with the ease of use I identified is Hargittai *et al*.'s (2010:477) finding that 'being able to identify easily the sources of information on the site' was most important. In their study, a visit to a search engine was a common first step when searching for information, underlining the role of prior experience with search engines and the associated effect of search engine brand. I also observed such routine behaviour, with every participant using *Google*; even though at least one participant had not gone to *Google* first, it was the only search engine used. As Hargittai *et al*. (2010:481) explain, 'name-brand recognition is a key component of credibility perception, for both the initial search process and the resultant pages a user decides to consult for information'.

Kahneman and Frederick's (2005) hypothesis of attribute substitution may provide a partial explanation for students' choice of a topic that they think will be easier, particularly when students experienced difficulty in finding resources on the topic they had first selected, or some other factor had taxed their personal resources, such as that the material available was at too high a reading level or would take too much time to process (for example, video material). The Kahneman and Frederick hypothesis describes a situation in which a person faces a difficult question; the person chooses an easier question to answer, often unwittingly selecting that easier question. When unable to answer the difficult question, the person substitutes a question that will offer a plausible answer. Their hypothesis is not fully supported by my data, however, considering that the simpler course of action appears to have been taken consciously by students. Students were aware of, and were able to articulate, their reasons for substituting a topic choice when they found that it was difficult to pursue their original topic (for example, Daniel, Appendix 4.4, A.9). Kahneman and Frederick's attribute substitution hypothesis, in which 'a highly accessible attribute controls the evaluation of a less accessible one' (2005:272), is thus incompletely supported by data in the current study.

In the context of pragmatism, consider the role of the related ideas of satisficing and legitimate effort. The former refers to information seekers' perceptions of when they have both satisfactory and sufficient information for the completion of the task in hand. Valentine (2001:110) uses the latter notion to refer to academic work that meets 'the minimum

requirements for getting a desired grade in a given class or on a given assignment'; Valentine's student participants decided what constituted a legitimate effort after an assessment of what instructors wanted and their personal academic goals and commitment. When both instructors and students interpreted legitimate effort similarly, satisfaction with results ensued. Satisficing behaviour (also referred to in Sections 5.4 and 5.6.1 below) and the expenditure of legitimate effort clearly coincide when the student concludes that enough resources have been spent on a task to achieve an acceptable grade. Tacit agreements, or explicit ones (such as appear in written forms of tasks and in verbal guidance when tasks are elaborated upon in class), form part of the socio-academic context in which students and instructors operate. Valentine's (2001:108) investigation underlines the pedagogical challenges, for educators, of students' satisficing behaviour and their perceptions of what constitutes legitimate effort when trying to develop new habits of information behaviour in students comfortable with their convenient, pragmatic approach: 'They move into new territory reluctantly, chaotically, and many times only if they feel the professor requires it'.

Educators' expectations of students' abilities to cover a field thoroughly must take into account both the time and information processing skills of students. It appears unrealistic to expect optimal outcomes, given the natural limitations of time available for task completion. Educators should, however, employ strategies that will encourage students to complement their use of *Google* and *Wikipedia*, developing in students a familiarity with other resources, so that limited time can be used to access a broader range of resources, which in turn may assist in developing broader coverage of topic areas by students. In open-ended tasks, optimal conditions rarely prevail (Agosto 2002) in which someone could locate all information related to the topic, process it, and present it. Satisficing behaviours will be evident in almost all information seeking and use behaviour.

Hofer (2004) refers to three studies by her research team of high school and college students who undertook a simulated science-related task that required participants to think aloud when searching for information. Some of Hofer's team's preliminary understandings coincide with my study's findings. These include not only the apparent lack of deliberate thought in relation to searching, and the greater likelihood that a general search engine will be used in preference to the library catalogue, but also that students are apparently satisfied with matches between search strings and retrieved material 'and seem to spend less time evaluating the material itself than educators might wish' (Hofer 2004:53). Other, more specific areas of agreement

with Hofer's findings are: comprehensibility of material; and length of source (overlapping with depth of topic treatment). While Hofer (2004) reports that students with the most subject expertise in science were more likely to use recency as a criterion for selecting sources, this was not noted in my study. This is most likely related to the topic areas investigated by my study's participants: many were history topics; a music topic was essentially about the history of music; and, even when a science topic was investigated, it was about the physics of greenhouses, a topic for which more recent material would have been unlikely to offer new information.

In line with naturalistic decision making theory, the participants in my study had developed ways of completing tasks in the limited time available to them. Rather than achieving the optimal outcomes predicted by classic decision making theory (in vogue prior to the mid-1950s), students achieved 'good enough' results, given the impossibility that all potentially relevant information sources could be examined, and time to examine sources was limited. Cognitive limitations, such as not being able to understand material or finding that information was not organised in easy-to-access ways, also restricted participants' ability to adopt an exhaustive approach to information searching and use. The heuristics employed by participants showed their short-cut methods for finding information quickly and with the least effort to achieve satisfactory task completion. Thus, the convenience and pragmatism of their approach was suitable for their purposes and should not be construed as an approach whose label carries any pejorative connotations. What appears as shallow processing of information in a convenient and pragmatic approach (*cf.* Hofer's (2004) surprise at the rapidity with which students considered and discarded sources), according to LeBoeuf and Shafir (2005:259), 'cannot be attributed to laziness, inexperience, or lack of motivation'. Patterns of apparently shallow processing of information are still observed when participants are offered greater incentives, when they are expert decision makers, when they provide justifications for their choices, and when they are people whose nature is to be deep thinkers (LeBoeuf & Shafir 2005). Completing tasks out of habit, or in ways perceived to be easier, may reduce cognitive load and save time, but there is a risk that the price is some inefficiency or ineffectiveness for the information seeker; however, it appears that the price is small enough not to affect the outcome substantially (see fast and frugal heuristics in Section 5.4).

5.4 Relevance priming

Participants in my study were intent on finding an introduction to their chosen topic. Such an introduction was commonly found in a *Wikipedia* article. I have referred to the source from which an overview was formed as a prime source, and noted its strong influence on what was noted as relevant in subsequent information sources. I call the phenomenon 'relevance priming' because, after concepts gleaned from the teacher-provided task and the subsequent interpretation of these for the purposes of creating a search string, the first information source was the most important source in a chain of sources that the student would consult. The prime source formed the basis on which relevance chaining, considered Section 5.5, could begin. In order to find a prime source, students depended heavily on the first or early occurring results returned by a search engine. Participants' search for an introduction to a topic in which they had little or no background was a pragmatic and effective strategy to begin building knowledge. (Data extracts relating to relevance priming appear in Appendix 4.5. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

Participants generally used a *Wikipedia* article to gain an overview of their topic of investigation (Appendix 4.5: A.1, A.9, A.10, A.11, A.18, A.21, A.22, A.23, A.26, A.28, A.30, A.32, A.33, A.34, A.35, A.37, A.38, A.39). Three students were identified as having used non-*Wikipedia* sources as introductions to their topics (Mia, Maria and Gerard). Kathy and Maria used knowledge they had before undertaking the task to prime their searches (Appendix 4.5: A.2, A.5). Two students, Amber and Victoria, explicitly used print sources. In general, students sought sources that provided broad treatments of their topics (Appendix 4.5: A.12, A.17, A.19, A.20, A.25).

In the remainder of this section, I consider 'surveying' as a concept related to relevance priming, before proceeding to consider students' need to build general background information, and the popularity of *Wikipedia* to provide a map of distal information. The section continues, with references to the influence of first-found information as related to relevance priming, and, finally, to an outline of notions that include the stopping rule, the principle of least effort, bounded rationality, and ecological rationality.

Having labelled ‘relevance priming’, I found the work of Ellis and Haugan (1997:395), who use ‘surveying’ for a similar purpose, characterising it as part of the ‘initial search for information to obtain an overview of the literature within a new subject field, or to locate key people operating in the field’. The correspondence between the two notions is further strengthened by its application to situations where the information seeker is unfamiliar with the topic. I therefore consider them synonymous; however, I shall continue using my label throughout this report to permit any potential subtlety of the phenomenon to emerge.

In a study of eleven students from a university in Finland preparing a proposal for research for a master’s degree, Vakkari (2001:304) also notes that a search for ‘general background and theoretical information… giving an overall picture of the topic’ influenced relevance judgements in the early stages of the ISP. Armed with some key ideas from their introduction, related information in subsequent sources stands out more clearly to information seekers. Couched in the terms of Gernsbacher (1990), similar memory cells are more likely to be activated when incoming information is consistent with prior knowledge and thus contribute to developing an existing mental structure; when not consistent, the information may be ignored or activate a new mental structure or substructure.

Anchoring is ‘the process by which numeric estimates are assimilated to a previously considered standard of comparison’ (Newell *et al*. 2007:208). I have broadened this concept to encompass the process by which subsequent sources of information become assimilated to presumably relevant and reliable information found earlier. Eighteen participants in my study reported using a *Wikipedia* article as the launching pad to other information. With little or no background knowledge in a topic area, an easily accessed *Wikipedia* is very attractive as an introduction. The information in the article is presumed by the participant to be accurate, but only provisionally, and then forms the basis on which to build a fuller picture of the topic under investigation. Given the position of primacy that such an article enjoys, it exerts considerable influence over any other information that is subsequently read by a student. This influence is further strengthened when a student uses a process of corroboration between the content of the *Wikipedia* article and the content found in a new source. The image of an anchor is appropriately applied to the *Wikipedia* article, as it prevents him or her from drifting off to different information. When a choice becomes accepted as a primary one, it has the potential to anchor choices that the information user subsequently comes across, becoming

more convincing to the user through its association with other pieces of like information.

While my study found that participants used *Wikipedia* to gain an overview of their topic area, Westbrook (2006:572) found that the thirty-four graduate students in that author's study used *Google* for a similar purpose: it was used 'primarily as a means of intellectual orientation to the basic nature of the research topic rather than as a viable source of meaningful information'. The Westbrook study makes no mention of *Wikipedia*, and it may be that the encyclopaedia provided the intellectual orientation referred to when one of its articles was retrieved in a *Google* search. Congruent with my findings, Metzger, Flanagin and Medders (2010:422) found that those of their 109 adult participants who used *Wikipedia*, considered it 'especially good for getting the basic facts on a topic'.

My reading of Fu and Gray (2006), particularly the extract below (2006:196), led me to conclude that participants in my study were strongly motivated to find proximal information:

> Most distal properties of the environment (such as the utility of information) cannot be directly perceived … Rather, these distal properties have to be inferred from proximal information obtained from dynamic interactions of the person and the environment.

The overview, that is, the proximal information, sought by students, for example, in a *Wikipedia* article, functions as a surrogate map of the distal properties of the complete information environment. With limited knowledge of a topic area, students in the current study needed to find proximal information quickly in order to build knowledge. The complete information environment, even within a particular topic area, cannot be known, given our bounded rationality (see later in this section). Most of a topic area's 'signposts', however, in the form of its main points, can be gleaned from a comprehensive overview. Use of a *Wikipedia* article, as a predominant choice, is an attempt to assess the scope of the topic. This then sensitises the seeker to what may or may not be relevant. Priming renders some aspects of subsequently read sources more salient than they would otherwise have been (based on LeBoeuf & Shafir's [2005] view that momentary priming influences subsequent preferences). Knowledge of the scope, which is part of prior knowledge (even if very newly acquired), therefore plays an important role in what a student decides is relevant in subsequent sources (see Section 5.5). Participants in Taylor's (2012:online) study 'did appear to make use of

general information sites such as Wikipedia, but they did not select these sites consistently throughout the search process', suggesting that a topic overview may be used at various stages of the ISP, rather than at early stages only.

Typically, the first page of results from a *Google* search will offer a link to a *Wikipedia* article, and this will generally be found among the first three results. The position of such a result that coincidentally offers a much-needed introduction of a topic area to a student is an important reason for its use. Aula and Nordhausen's survey of studies examining the log files of search engines concluded that Web users 'typically only check one result page' (2006:1678). Cognitive psychologists have for some decades recognised the impact of first-presented information on subsequent information processing. Gernsbacher (1990:9) found, for example, that 'Comprehenders spend more cognitive capacity processing initial words and sentences than later-occurring words and later-occurring sentences'. Psychologist Gernsbacher found that subjects spent more time looking at the first picture of a story than they spent looking at pictures that occurred later in the story; she noted a similar result in relation to the first picture of each episode when comparing it to pictures that occurred later in the episode. Gernsbacher called this phenomenon 'primacy' and, although her research was in the field of language comprehension, her observations were of general cognitive processes and mechanisms. Students in the current investigation expended more time cognitively processing early-occurring search results than later-occurring ones; similarly, they spent more time on initial websites (those on the first page) than on ones that occur later (Paul was the only participant to refer to proceeding beyond the first page, and that was not for an academic task; see also Appendix 4.4: C.12, C.19, C.21, C.22, C.31, C.32, C.33, C.34, C.38, C.39).

Sadler (2002) cites the work of Wason, who found that the first few informational stimuli were used as a baseline, or for calibratory purposes, so underlining the importance of the order of the information. This is similar to Gernsbacher's notion of the privilege of primacy (or the advantage of first mention) and fits with two major observations of the present study: that students used early results; and that they used a second piece of information to corroborate the facts in the first-found piece. In relevance priming, the source offering an overview or introduction became the baseline information, and was subsequently used to calibrate information in sources that followed. As Ruthven (2005:76) puts it, 'viewing one relevant document can change the user's perception of the relevance of subsequently viewed documents'. More than 25 per cent of participants in the Hargittai *et al*. (2010) study selected

the first result in a set of search engine results. The authors interpreted this as a demonstration of the participants' trust in the search engine. It also demonstrates the effect of primacy, and the convenience of depending on the search engine to make relevance judgements for its users. In the current study, the role of providing baseline information was abrogated to the *Google* search engine, which became trusted to provide early results that were of sources that were easy to understand and offered a convenient introduction.

Early and easy solutions are frequently attractive to decision makers. This is the underlying reason why *Google* and *Wikipedia* are so appealing and why users will go back to these resources habitually. Many students, however, reported positive experiences with books and indicated their intentions to return to them when completing similar tasks in the future, despite the additional effort required to access such information. The primacy of first-presented or first-found information is likely to be reinforced by several other phenomena noted in decision making theory; for example, that 'information that is available is also perceived to be more frequent, probable and causally important' (Newell *et al*. 2007:35). A fixation on a solution found early might be a symptom of a maladaptive problem solving strategy, particularly if its sheer availability leads the user to believe that it is reliable. Equally, the early selection of, and fixation on, a choice may lead to an outcome that is acceptable to the decision maker (see fast and frugal heuristics later in this section). Whichever choice is selected on a preliminary basis, pending the possible consideration of other choices, tends to assume primacy. Although Svenson (2003) notes the primacy of a preliminary choice alternative, which has an advantage over competing alternatives by virtue of its position as the preliminary choice, the author allows room for the possibility that new preliminary choices may supplant old ones. In the case of Sophie in the present study, the selection of a book that met her immediate requirements effectively precluded the consideration, or at least reduced the chances of consideration, of other information.

Operating in conjunction with primacy and the dominance of the preliminary choice is the stopping rule referred to by Gigerenzer (2004). The stopping rule is a reason-based heuristic that is one of three building blocks of the 'Take the best' heuristic and which proposes that the 'search is stopped immediately after the first discriminating cue is found, not beforehand and not later' (2004:75). 'Take the best' operates in binary situations in which the decision maker categorises information into two categories: information recognised and information not recognised. The recognition principle of the 'Take the best' heuristic operates in such a

situation. I suggest that relevance is the discriminating cue in my study; that what is recognised, from prior experience, is assessed as relevant. The prior experience need not be drawn from long-term memory; it may be that the topic of the task has only just been chosen, and the content of the freshly chosen topic is recognised in the search results. Relevance between topic and information source(s) is then recognised; in the early stage of an information search, once the required topic overview has been found in a source, the search for that type of source is stopped.

The stopping rule, in turn, is related to Zipf's principle of least effort, which posits that 'an individual's entire behavior is subject to the minimizing of effort' (1949:6). This does not imply that an individual is lazy but that the individual expends the least amount of energy required to perform a function. The principle may be applied here informally as 'Stop when you recognise information that is relevant to your information search need, namely an overview of the subject of your search'. There are preliminary stopping points when the user has extracted enough information from specific, individual sources, and a final stopping point when sufficient information has been drawn from a sufficient number of resources. I suggest that relevance 'closes the loop', that it activates the stopping rule. 'Research suggests that people hardly ever make conscious decisions about which heuristic to use, but that they quickly and unconsciously tend to adapt heuristics to changing environments, provided there is feedback …' (Gigerenzer 2004:77). When relevance is fed back to the user, the stopping rule in relation to that particular information source is applied. Once assessed as relevant, there is no need to find another information source that offers an introduction; however, the student moves on to find another type of source, that is, one or more that will corroborate information found in the overview source.

In order to understand further why participants find easy, early and familiar sources attractive, in what appears to be an approach of convenience and pragmatism, an understanding of bounded rationality is useful. Early theories, notably expected utility theory (EUT), under the umbrella of rational choice theory, implied that we had unlimited time to make choices and that we were able to take into account all available options to arrive at an optimal decision (Newell *et al*. 2007).

Herbert Simon refuted this in the 1950s, postulating bounded rationality as a more accurate reflection of how we behave, and describing decision making more realistically as the following (1955:99):

> a kind of rational behavior that is compatible with the access to information and the computational capacities that are actually possessed by organisms, including man, in the kinds of environments in which such organisms exist.

In terms reflecting gender usage of the period, Simon (1955:99) criticises the assumption of traditional economic theory that man is both 'economic' and 'rational', claiming that:

> This man is assumed to have knowledge of the relevant aspects of his environment which, if not absolutely complete, is at least impressively clear and voluminous. He is assumed also to have a well-organized and stable system of preferences, and a skill in computation that enables him to calculate, for the alternative courses of action that are available to him, which of these will permit him to reach the highest attainable point on his preference scale.

Simon characterised bounded rationality as rationality that is constrained by factors in the decision making environment. Examples of such constraints include the cost of obtaining information, in, say, time; and limitations of human processing powers, such as in understanding or recalling information (Gigerenzer 2004). Simon refers to 'the simplifications the choosing organism may deliberately introduce into its model of the situation in order to bring the model within the range of its computing capacity' (1955:100).

Instead of optimal decisions, Simon suggested that, using our limited resources, we make 'good enough' decisions. In addition, 'intuition and affect provide important mechanisms of bounded rationality, and thus can be conceived as the key determinants of routine decisions' (Betsch & Haberstroh 2005:373). Todd and Gigerenzer consider satisficing (see Section 2.2.4) to be one of a set of 'fast and frugal' heuristics, usefully defining 'heuristics' as 'simple rules in the mind's adaptive toolbox for making decisions with realistic mental resources' (2000:727). A writer of popular science works claims that '… decisions made very quickly can be every bit as good as decisions made cautiously and deliberately' (Gladwell 2006:14).

There does appear to be mounting evidence that there is no attendant loss in the quality of a decision simply because it has been made fast and frugally (Newell *et al*. 2007:39):

> …the bounded nature of human cognition can, in certain environments, give rise to advantages in terms of frugality and speed of the decision process without suffering any concurrent loss in the accuracy of judgments and decisions.

This contrasts with what was formerly believed; for example, Dawes (1988:7), who claimed that automatic thinking processes employing heuristics 'systematically lead us to make poorer choices than we would by thinking in a more controlled manner about our decisions'.

Another aspect of humans that influences their rationality is emotion. Emotion may hinder or help our decision making: it precipitates as well as stops action. The role of emotions in decision making is associated with bounded rationality when they form part of the constraints of our environment. This is how Anderson (2007:189) puts it:

> Instead of being states of action readiness, emotions are better conceived as reactions to human vulnerability (Nussbaum 2004). Nussbaum suggests that humans are inherently vulnerable because they are mortal, have limited control, and are social creatures, and without these vulnerabilities, emotions would serve no purpose.

Despite the considerable influence of EUT until the mid-1950s, decision theorists now agree that we operate within the bounds of our environment, an environment that includes limitations on the time we can devote to particular tasks, and therefore to the decision making inherent in those tasks, and restrictions on the cognitive resources that we can apply to tasks. Herbert Simon's concept of bounded rationality has given us an ecological explanation of how we typically operate as decision makers. Such ecologically rational behaviour is 'appropriate in its niche but does not assume an underlying optimisation model' (Hogarth & Karelaia 2006:125). As Doherty indicates, now 'even the most ardent optimists see rationality as bounded' (2003:648). Participants in the current study, subject to constraints (for example,

on their time and cognitive resources), were pragmatic, and adopted the earliest relevant results that met their needs. In this, they demonstrated behaviour consistent with naturalistic decision making theory.

Gigerenzer's concept of ecological rationality is closely related to Simon's bounded rationality in that both refer to limitations in the environment of the decision maker. Decision tasks impose limitations, and cognitive resources of decision makers are finite. Goldstein and Gigerenzer refer to ecological rationality as being an 'ability to exploit the structure of the information in natural environments' (2002:76). Ecological rationality is associated with some degree of expediency or pragmatism, and demonstrates that we adopt solutions that work for us in the environment in which we find ourselves. The words 'expediency' and 'pragmatism' are not intended to be interpreted in their disapproving or disparaging senses, which may suggest unprincipled behaviour, but in the sense that the most appropriate behaviour in the circumstances is employed to complete the task. This nuance is emphasised by Gigerenzer (2004:64): 'Ecological rationality implies that a heuristic is not good or bad, rational or irrational per se, only relative to an environment'. The selection of a topic overview by participants in my study from a familiar source demonstrates ecological rationality.

Gigerenzer (2004:68) describes what happens when a decision maker uses the recognition heuristic: 'If one of two objects is recognized and the other is not, then infer that the recognized object has the higher value with respect to the criterion'. While this applies to a choice task that has two alternatives, I believe that Gigerenzer's explanation is also applicable to situations where there are multiple alternatives. Where choices in the form of a page of search results from a search engine are offered to the user, the user will select one that comes from a source that he or she recognises. An important criterion used by the finder of information is, 'Does this source meet my information need?' Specifically, the criterion is relevance. The source becomes strongly associated with success at meeting the user's information needs. The user then remains systematically ignorant of other resources that may meet his or her needs as well, or even better. Once *Wikipedia*, or *Google* for that matter, has become strongly associated with being an information source that will have what he or she is looking for, or a gateway to potentially relevant sources, it becomes difficult for the student to develop the same association with another information source. Superficially, this seems explicable in simple behaviourist terms, that is, as positive reinforcement for adopting a

particular behaviour, which is further reinforced if the student achieves a grade in line with his or her expectations. However, the recognition heuristic, as a manifestation of ecological rationality, goes further on at least two counts: by explaining which aspect of the behaviour has been reinforced and by what mechanism that has occurred; and by explaining why a similar experience with another information resource that, say, the student has been compelled to use, and that has resulted in a similar successful outcome, would not be returned to. In that sense, the recognition heuristic explains the enduring nature of a habit. If the intention of the educator is to change the repeated use by students of a recognisable resource, tasks need to be designed to require the repeated use of a different resource until a similar level of recognisability is achieved.

Commonly, an information seeker is initially attracted to a source that offers a summary or outline of the main points of the matter under examination. In the same way that participants used the information in search results as proximal information to gain an idea of what the distal information source may provide, they used the prime source as a map of the territory that would be covered in more detail in subsequent, non-prime sources. The subsequent sources were important to establish, retroactively, the reliability of the information provided in the prime source. A key criterion in that prime source was its relevance to the searcher's topic, along with its ability to provide a concise view of the topic. The early positioning of a potentially prime source in the results of a *Google* search played an important role in its selection. Much of the convenient and pragmatic approach observed throughout most aspects of participants' ISP is seen in the adoption of an overview-providing source. Once identified as a prime source, the search for such a type of source could be terminated and the next stage, the search for a corroborating source, could begin. The finding of corroborating sources was important in relevance chaining, which is considered in the section that follows.

5.5 Relevance chaining

The knowledge developed during relevance priming, considered above, is used in the next stage of relevance judgements, relevance chaining. That knowledge has a catalytic effect on subsequently found information. Even though the information in the former source (from which an overview is derived) is not evaluated for reliability (corroboration is the prime means of establishing reliability and the information seeker is reading the overview information for the first time), its information attracts the seeker's attention to subsequent information. The former source has no confirmed reliability properties until activated by the subsequent information. Judgements of reliability of the former source, generally a *Wikipedia* article, are held in abeyance, largely influenced by the perception that teachers have globally judged the online encyclopaedia unreliable. The students, within the discursive practice of the school, feel hesitant to assert reliability judgements of *Wikipedia* that are contrary to their teachers' judgements. They therefore give priority to relevance over reliability, use the framework of the article as a guide to what should be considered relevant in an investigation of their topic, suspend reliability judgements of the *Wikipedia* article and then, when they find supporting information in another source, attribute primary reliability to the later source, and, retrospectively, attribute a type of secondary reliability to their prior knowledge developed from *Wikipedia*. That students, with only one exception, did not go directly to the *Wikipedia* site, going instead to *Google*, may suggest a desire to chain, that is, an intention to find, in one step, an overview and related information. (Data extracts relating to relevance chaining appear in Appendix 4.6. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

Several participants used the information found in one source to search for information in other sources. Examples may be found in Appendix 4.6: A.10, A.19, A.21, A.25, A.29, A.31, A.35, A.36, and A.38. Each example relates to task-bound relevance chaining, that is, the use of information found by a student, while completing the task, as the basis for finding another piece of information. Relevance chaining is sometimes broader, however; for example, its genesis is in a student's experience that occurred before undertaking the task. This is the situation when a student uses knowledge, developed before beginning the task, as the first link

in the relevance chain (see Appendix 4.6: A.1, A.2, A.3, A.4, A.5, A.9, A.10, A.11, A.21, A.22, A.24, A.26, A.27, A.28, A.33, A.34, A.37). When Sharon and Sophie found that they could not link information to their prior knowledge, they rejected it as irrelevant or redundant (Appendix 4.6: A.32 and A.33). When Rachel was selecting a topic to investigate, she excluded topics on the Cold War because this period in history had not yet been discussed in class (Appendix 4.6, A.23), indicating that, in the absence of prior knowledge, relevance chaining would not be possible, and thus make the task more challenging. Noah and Lily used their background knowledge, matching it against what cropped up in a search, to test the reliability of the found information; this indicates the role of relevance chaining in establishing the dependability of information (Appendix 4.6: A.4 and A.12). Four students used the citation(s) in one source to explore the topic further, revealing another means of relevance chaining (Appendix 4.6: A.8, A.18, A.36, A.38).

In the remainder of this section, I discuss the uncertainty principle as a motivation for seeking information, and compare relevance chaining with similar behaviour described in the literature. The section then continues to a discussion of the role of prior knowledge, and its relation to making connections between old and new information; the integration of information from a variety of sources; and the role of deliberative processing, in which explicit reasoning and conscious awareness play a role.

Kuhlthau (2004:92) discusses the uncertainty principle, describing it as 'a cognitive state that commonly causes affective symptoms of anxiety and lack of confidence' and positing it as the phenomenon that 'due to a lack of understanding, a gap in meaning, or a limited construct initiates the process of information seeking'. One of the six corollaries in which she elaborates her perception of the uncertainty principle is a redundancy corollary, briefly defined as 'encountering the expected and unexpected' (2004:103). I suggest that this corollary is at play in relevance chaining because the information seeker is judging whether a new source contains information that is unique, or unexpected, or whether it is redundant, or expected because it is already known. The focus of the participant in relevance chaining, then, is on what Kuhlthau would term redundant information, so that connections can be made between prior knowledge and matching information in the source under immediate consideration. (Matching is further considered in Section 5.6.2 below.) When unique information is encountered, the seeker must develop a new construct to accommodate it,

unless it is rejected as irrelevant. Participants were possibly strongly motivated, however, to find redundant information in an effort to decrease their uncertainty. This would also explain how the position of the prime source is reinforced: the information that is found in posterior sources that is consistent with that found in the prime source is bolstered by being recognised as trustworthy, under the influence of its repetition, thus strengthening the construct already in place in the prior knowledge of the participant.

Following my labelling of participants' linking of information to knowledge acquired at an earlier point as 'chaining', I read of the work of Ellis and Haugan (1997), who identified chaining as one of eight behaviours in the information seeking patterns of engineers and research scientists in Norway. Ellis and Haugan use the term to mean 'following chains of different forms of referential connection between sources to identify new sources of information', an activity 'mainly performed by following references in one particular article as a starting point' (1997:396). Reference chaining and the chaining of relevant sources appear related, with the former subsumed in the broader latter. Barrett's (2005) study of the information retrieval patterns of humanities graduate students in Canada identified 'citation chasing', which is synonymous with Ellis and Haugan's chaining.

There is an even broader aspect of chaining: it includes making connections between one learning task, whether in the same curriculum area or not, and another; and the making of connections between a learning task and knowledge gained outside the school environment. This is seen in the choice of topics by students and was treated in Section 4.4.1.1. The use of existing knowledge as the foundation on which to build new knowledge has pedagogical implications. Students should be encouraged to make links with topics covered elsewhere in the curriculum and out of school in order to extend their knowledge gained there and to increase their engagement with the subject matter. Such an approach also assists students to see that learning and knowledge have been fragmented along subject lines only for convenience of teaching. The background knowledge that students bring to their selected topic, whether from formal or informal learning, provides the 'hooks' to which to attach new knowledge. Drawing on Gernsbacher's (1990) concept of a structure building framework, students' background knowledge forms the foundation of a mental structure, which they subsequently seek to develop. Students use two cognitive processes to build on their

foundation, which Gernsbacher (1990:51) refers to as mapping and shifting:

> Comprehenders map incoming information onto a developing structure or substructure when that incoming information coheres with the previous information. When the incoming information is less coherent, comprehenders employ a different process: They shift and develop a new substructure.

A task that requires a student to integrate information from a variety of sources appears to lead to more effective learning (see also Section 5.8). Cerdán and Vidal-Abarca (2008), for example, explain this effect as arising from the requirement that the reader of the information focus on a particular piece (or pieces) of information, thus leading to more careful processing of it. The knowledge developed by the student from the prime source gives specific details on which to concentrate when accessing subsequent information sources, and thus forms the first link in the chain. When the reader notes related information, it becomes incorporated with prior knowledge. The study by Cerdán and Vidal-Abarca, of undergraduate students at a Spanish university, found that task design influenced the students' integration of information: 'The more integration a task requires, the better the results in terms of the learning it produces' (2008:221). Coiro and Dobler (2007) refer to research that shows that we activate prior knowledge while constructing meaning. Coiro and Dobler also acknowledge the studies showing that 'skilled readers of printed text regularly make connections and monitor their understanding of what they read within one text … and across multiple texts' (2007:242). The activation of prior knowledge and subsequent connections between one piece of information and another were major activities of the chaining observed in my study. The important role of prior knowledge in learning is agreed upon by constructivists, who interpret learning as 'an active, effortful process on the part of the learner to build his or her knowledge' (Muller, Sharma & Reimann 2008:281), and by most educational psychologists and cognitive scientists (Lattuca 2006).

When Paulsen and Feldman (2007) examined the cognitive and behavioural strategies of students in undergraduate courses, they included, among their cognitive strategies, four types: rehearsal, organisation, elaboration, and metacognition. Of most significance in a discussion of relevance chaining is their elaboration strategy, which they defined as the use by students of 'advanced strategies to establish internal connections between new information and their prior knowledge or experiences, such as summarizing or paraphrasing' (2007:358). Paulsen

and Feldman found that students who believed that our ability to learn is fixed at birth, rather than that we have the capacity to improve our ability to learn during the course of life, were less likely to use elaboration strategies. I hypothesise, on the basis of the high incidence of information linking in my study, that participants did not have naïve, fixed ability views, adopting elaboration strategies that resulted in deeper processing of information. Tasks designed to require the use of multiple sources probably encouraged the development of the more advanced cognitive strategy of elaboration that is associated with effective learning. Furthermore, such development is probably stimulated even more explicitly when related to an area in which knowledge is problematic, that is, open to interpretation and subject to change in the light of our evolving understanding, Mannes and St George (1996:115) refer to 'a priori organization, or the ability to organize thoughts as they are encountered', which is based on prior knowledge; this skill appears important to students' ability to make sense of information. Lattuca (2006:356) advocates that students' prior knowledge 'must be surfaced, reflected upon, critiqued, discarded, or elaborated and refined in our curricula'. Brooks and Shell also stress the role of prior knowledge in learning: they point to Schraw's Interactive Compensatory Model of Learning, where it 'accounts for at least 36% of the variance when considering subsequent performance' (2006:20); and 'prior learning (i.e., cortex-based storage) makes the biggest contribution to successful new learning' (2006:25). Information search tasks give students opportunities for these activities.

Having considered the role of prior knowledge in relevance chaining behaviour, I now turn to another type of prior knowledge, from the socio-academic context of the information search task, that of students' preconceptions about their teachers' credibility judgements of *Wikipedia*. The effect of teachers' views of the reliability of *Wikipedia* need not be perceived as negative; on the contrary, while the effect may result in students hiding the importance of *Wikipedia* to their academic lives, it may actually benefit student learning. An understanding of dualism in decision making theory is useful to an explanation of how teachers' views may promote learning by invoking a more deliberative than intuitive mode of processing. The literature commonly portrays a dualistic distinction in types of decision making: deliberative processing is contrasted with rule-based processing (Johnson & Busemeyer 2005); A-mode processing, or autonomous change of activation, is distinguished from S-mode processing, or supervised structural change (Betsch 2005); and deliberations that are intuitive, or tacit, are portrayed as theoretically distinct from those that are analytic, or deliberate (Hogarth 2005).

Basing his multiple-process cognitive theory primarily on Stanovich and West's distinction between intuitive and analytic processing, Bakken (2008) suggests that we most commonly use the intuitive system and seldom bring analytic processes into play. Appendix 4.4 offers nine examples of participants relying on intuition; it is unlikely that these are examples of students simply unable to articulate a process, given their ability, generally, to express their learning experiences eloquently. Kristian and Sharon, particularly, excluded a deliberative approach. Loewenstein, Weber, Hsee, and Welch (2001:270) cite Sloman's distinction between rule-based processing, 'a relatively controlled form of processing that operates according to formal rules of logic and evidence and is mediated by conscious appraisal of information', and associative processing, 'a more spontaneous form of processing that operates by principles of similarity and temporal contiguity'. Scholars agree that not all so-called deliberations are deliberate; some occur beyond our conscious awareness. Bakken (2008); Baumeister, DeWall, and Zhang (2007); and Hogarth (2005) contend that the intuitive system is our primary system of making decisions.

The portrayal of a dual systems approach to decision making is typically based on a distinction between cognition that is conscious and cognition that occurs without conscious awareness (Hogarth 2005). Weber and Johnson (2009) provide a succinct summary of contemporary explanations that adopt a dual-process approach to decision making. An important explanation comes from Kahneman, whose distinctions between the two systems are cited in Weber and Johnson (2009:67): 'a rapid, automatic and effortless, associative, intuitive process (System 1) and a slower, rule-governed, analytic, deliberate and effortful process (System 2)'. Few scholars question the dual-process framework of decision making (Bakken 2008).

In deliberative processing, the suggestion is that an individual engages consciously in cognitive processes that are costly in terms of resources for the individual. The resources that are consumed may be attention, commonly regarded as a limited resource, and other resources required for conscious, cognitive processing, such as those associated with pattern discernment (Johnson & Busemeyer 2005). In rule-based processing, the individual applies a set of rules with little or no conscious awareness. These rules have been developed as a result of past conditioning and to that extent this model is associated with behaviourism, despite the few explicit references to this school of psychology in the literature. The effort required for cognitive processing in the rule-based system is negligible. A dualist approach is also seen in

the work of Betsch (2005), in which autonomous, or A-mode, processing is regarded as the system of decision making that we fall back on automatically, thus using it with minimal cognitive resources; and in which supervised, or S-mode, processing is 'characterized by attention, deliberation, and mental control' (2005:49). Decision making may occur without our awareness in the A-mode but in the S-mode we intervene in the process when we consciously act to influence the process.

Hogarth's deliberate system matches the type of decision making that Johnson and Busemeyer refer to as deliberative processing: Hogarth envisages explicit reasoning occurring in the deliberate system, which is 'mainly rule-governed, precise, and capable of abstract thought' (2005:68); Johnson and Busemeyer describe deliberative processing as 'calculated, resource-consuming processing' (2005:3). While these concepts may be regarded as similar, the same cannot be said of the contrasting item in the duality of the respective scholars: the notion of rule-based processing in Johnson and Busemeyer (2005) is not entirely analogous to Hogarth's tacit system. The notions part company when rule-based decision making is claimed to need 'significant information-processing resources (attention to relevant environmental cues, logical checks for the appropriate pattern of conditions)' (Johnson & Busemeyer 2005:12). The expenditure of resources in the operation of the process is generally associated with conscious deliberation. This contrasts with the automaticity of Hogarth's (2005) tacit system, that is, its operation with little or no conscious intervention. While the model in Johnson and Busemeyer (2005) views rule-based processing as resource-hungry, it does, however, consider habits, which the authors define as 'automatic reactions that require little or no information-processing resources' (2005:12), and habits thus may be thought of as having much in common with Hogarth's tacit system. The rule-based system portrayed in Johnson and Busemeyer (2005) appears to suggest an interphase between deliberative processing and habits, given that the effect of long-term experience of rule application would surely lead to the development of what they conceptualise as habits. The conditioning effect flowing from applying rules would introduce a level of automaticity.

In the view of Bakken (2008), intuitive processes are predominant over analytic processes. Agreeing with an evolutionary biology approach, Bakken posits that 'fast intuitive processing is dominant because of its superior selection effect on the human population' (2008:495). Baumeister, DeWall, and Zhang (2007) pursue a similar argument, citing findings that the calculation of probabilities, an activity associated with the cognitive system, plays second

fiddle to the perception of rewards and costs, which occurs in the emotion system. The primacy of the emotion system, they explain, reflects the likelihood that '[o]ur ancestors evolved from animals that had sophisticated emotion systems but little or no higher-order cognition' (2007:18). Baumeister *et al.* claim that 'reasonable and wise decisions' are based on 'conscious emotions' that take into account experiences of past emotions and 'anticipated future emotional outcomes' (2007:16). Their phrase, 'conscious emotions', is an interesting attempt to fuse emotion and cognition; awareness of emotions experienced in the past, and the conscious anticipation of what emotions may be evoked in the future, enter the decision making process and have a positive influence. Baumeister *et al.* suggest that 'Full-blown conscious emotion may often be too slow to guide on-line behavior effectively' (2007:14), but that it influences a post-decision phase, in what Svenson (2003) would call consolidation, during which reinforcement of the decision takes place. Baumeister *et al.* (2007:14) articulate the part played by conscious emotion as follows:

> [E]motion may arise after the event and help to solidify the lesson to be learned from the situation, partly by keeping the person engaged in mental processing about what happened and why. … Conscious emotion can therefore be considered as beneficial in terms of promoting learning under multifaceted, uniquely human conditions.

Paralleling Bakken (2008), Hogarth's tacit system enjoys primacy over the deliberate system, despite working in concert with it. Hogarth's deliberate system comes into operation 'when either the tacit system cannot handle the task or we make a conscious decision (e.g., planning what to do)' (2005:70). Intuitive processes, however, with which dynamic, everyday decision making is associated, are more difficult to investigate and have therefore been neglected until recently: 'both empirical and theoretical cognitive research in static decision-making dwarfs dynamic decision-making' (Bakken 2008:496).

While it may be tempting to advocate that teachers train students to treat *Wikipedia* like any other source, and evaluate each piece of information in the encyclopaedia on its merits, teachers' scepticism imparted to students may function to stimulate the operation of their analytic system of decision making. Rather than intuitively accepting the information in a

source on the basis of its relevance, such imparted scepticism invokes the operation of a more deliberate process, thus causing the student to consider the reliability of the information. The reliability of information is established primarily in a process of corroboration, which is considered below in Section 5.6.2.

5.6 Knowledge building

The filtering, matching and adding behaviours described in the previous chapter are not excluded from the relevance priming and relevance chaining stages; priming and chaining are subsumed in those three knowledge building behaviours. The type of filtering that occurred at the relevance priming stage was coarse, in that the participant's focus was on finding an overview; in relevance chaining, the participant was intent on finding information that matched that which had been found in the source providing the overview. At both points, knowledge is being built, thereby including knowledge building in relevance priming and relevance chaining. Filtering behaviour was noted as that used to sort relevant from irrelevant information and also to sort reliable from unreliable information; filtering employed a set of features to sort information. Matching behaviour is that employed by participants to match one piece of information with another for the purpose of comparing it with prior knowledge and determining the extent to which it matches, or corroborates, that prior knowledge. (Matching behaviour was described in Section 4.4.5.2.) I have used adding to describe the decision by participants to add information; this took the form of noting or recording information considered relevant, and other examples of interaction and engagement with information for the purposes of likely inclusion in a final product (typically an essay or oral presentation), such as drawing up a table or organising the collected information in some way, such as by themes and sub-themes. I consider adding to be the culmination of relevance judgements, although not necessarily reliability judgements. (Data extracts relating to knowledge building appear in Appendix 4.7. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

5.6.1 Filtering

Filtering behaviours in the data are associated with relevance priming; specifically, in participants' efforts to locate an introduction to topics, participants filtered out information sources that were too specific or detailed; for example, when Jenny found her retrieved sources too narrow in focus, she rejected these (Appendix 4.7, A.1); and when Daniel was close to presenting his completed task, and wished to reduce his material to fit a word limit, he sought sources offering general information, excluding detailed sources, in order to help him focus on the main points of his topic (Appendix 4.7, A.9).

Some students paid particular attention to information that suited their personal focus. Noah, for example, wanted to convey the excitement of fans of both Harry Potter movies and of the *Lord of the Rings* movie (Appendix 4.7, A.12). Amber also excluded sources that did not suit her personal focus, which was intertwined with her opinions about what were acceptable explanations for women coming to Australia in colonial times (Appendix 4.7, A.14).

Certain resource groups were also excluded from consideration, depending on the participant's information needs; for example, Kathy excluded books when she was investigating Paris Hilton (Appendix 4.7, A.2), yet Elizabeth put websites aside when she found that books treated her topic on the Olympics more thoroughly (Appendix 4.7, A.20); similarly, Sophie favoured books when she found that they offered a more detailed treatment of her topic than websites (Appendix 4.7, A.16). Lara discounted Internet sources, relying on her personal opinion (Appendix 4.7, A.3). Lily filtered out chat rooms, based on her perception that they were unreliable sources (Appendix 4.7, A.4).

Participants rejected particular websites in favour of others, based on their URLs, particularly their suffixes. Thus, Kristian considered a URL ending in '.gov' reliable (Appendix 4.7, A.17); Victoria claimed that she would prefer a website with a '.gov' suffix if she had to choose between two conflicting pieces of information; and Rachel held the general view that URLs ending in '.edu' were reliable. Rachel perceived websites with a '.com' suffix to be less reliable than others (Appendix 4.7, A.23). In related behaviour, Elizabeth rejected websites whose names did not sound professional (Appendix 4.7, A.20); and Mary-Ann passed over two websites that did not 'sound like they're going to be decent, reliable, scientific sites' (Appendix 4.7, A.31).

Website design was used as a discriminator. Richard rejected websites that looked as if little effort had been expended on their presentation (Appendix 4.7, A. 18); and Charlotte concluded that websites whose design was unsophisticated and offered distracting pop-up windows were to be avoided. Karen avoided websites that were 'showy' or contained 'too many advertisements' (Appendix 4.7, A.29).

Writing style was also a criterion used in filtering behaviours by participants. When the argument presented was persuasive, presented evidence, 'sounded intelligent', and treated the

topic in some depth, Karen considered it reliable (Appendix 4.7, A.29). Edward looked for signs that doctors had authored websites (Appendix 4.7, A.35). Stefano equated a lack of detail with a lack of effort and concluded that such websites did not warrant his attention (Appendix 4.7, A.39).

There were general efforts to separate relevant results from irrelevant ones in what may be called a winnowing exercise. Examples appear in Appendix 4.7: A.27, A.30, A.36, and A.37. Brian illustrates the practice of some participants who, when faced with a lengthy document, used the Edit-Find function of their Internet browser to search for a word or phrase relevant to their search tasks (Appendix 4.7, A.8). Sometimes the rule of thumb of 'use the first result' was applied, although participants also used those results appearing early in a list (Appendix 4.7: A.7, A.32, and A.33); this phenomenon is connected with the dependence on the search engine discussed in Section 5.3. Allied to the implicit assumption that what appears first can be used in relevance judgements was Mark and Victoria's use of the first sentence of a paragraph or the introductory paragraph to establish relevance (Appendix 4.7: A.26 and A.34).

In the remainder of this section, I discuss the role of predictive judgements, which may be considered part of the information seeker's inferential strategies, before making connections to the literature related to the use, in judgements of reliability, of URLs, a reputation heuristic, and design.

In Section 5.3 above, I discussed participants' pragmatic dependence on pre-access judgements, or predictive judgements of epistemic reliability (Taraborelli 2008). I now return to these judgements in the context of filtering behaviour. Pre-access or predictive judgements are those made on the basis of proximal clues, such as URLs, snippets, and titles provided in search engine results. Such clues offer the information seeker what has been called 'information scent' (Pirolli 2005; Pirolli & Card 1999) and have 'only a probabilistic relation to distal desired information sources' (Pirolli 2005:351). The examination of such information scent was an important part of participants' methods of filtering information to find what they considered most relevant. Other filtering behaviours include judgements of the apparent depth with which an author treated a topic, which was allied to writing style; whether the source was organised for easy comprehension; the reputation of the source; and website design.

Participants in the present investigation used URLs as clues to the reliability of information, showing less trust towards '.com' sites and preferring URLs containing '.org', '.edu', and '.gov'. A similar observation was made by Hargittai *et al*. (2010): '.edu' and '.gov' sites were perceived as more credible. Many of that study's participants also trusted information from '.org' sites, despite such sites not being distinguishable from the less trusted '.com' sites: 'that domain is as freely available for registration as dot-com and is not for nonprofit organizations only as might have been its original purpose' (Hargittai *et al*. 2010:483). Metzger *et al*.'s (2010) observation that participants considered it necessary to gauge the expertise and intelligence of information providers applies to my study also; both studies' participants used similar characteristics of information sources to judge credibility: 'topic mastery, writing style, spelling and grammar, and the extent of details offered' (Metzger *et al*. 2010:424), which correspond closely to my identification of depth of topic treatment and writing style.

Metzger *et al*. (2010) include the reputation heuristic among five heuristics to judge credibility. This heuristic was used by my participants when using reputation of sources to indicate reliability. Examples of sources judged to be from reputable providers of trustworthy information include *Encyclopaedia Britannica*, the BBC, and the *Sydney Morning Herald* newspaper. Source reputation was discussed in Section 5.2 as an indicator of information quality derived from the student's socio-academic context.

Design was a factor used by participants to judge the reliability of an online source; design includes typography, layout, colour, and advertising. Stefano, a participant in the current study, found that colourful backgrounds, pretty pictures and moving borders gave him the impression that the website creator was dressing up the information and led him to be suspicious of the creator's content expertise. Stefano's experience contrasts with that of students, with an average age of nine years, who accorded text on a white background lower credibility (Eastin, Yang & Nathanson 2006). Almost twice the age of Eastin *et al*.'s participants, Stefano's preference for black text on a white background may reflect a developmental difference, which Stefano himself hinted at when he suggested that fancy design was appealing to a child. The employment of the expectancy violation heuristic explains the rejection by participants in my study of websites that were poorly designed or that contained distracting advertising. Metzger *et al*. (2010) refer to the expectancy violation heuristic when discussing the tendency of participants in their study to judge online

information as lacking in credibility when it did not meet the standards that they associated with credible information. Fogg's (2003) prominence-interpretation theory is also helpful to explain the negative impact on credibility of such features; in the theory, prominence is 'the likelihood that a Web site element will be noticed or perceived' (2003:722) and interpretation is 'a person's judgment about an element under examination' (2003:723). The design is noticed and becomes important in an evaluation of credibility; when interpreted as inconsistent with the information seeker's perceptions of what constitutes professional design, the information is viewed negatively.

While the expectancy violation heuristic may explain the rejection of websites that looked unprofessional, Metzger *et al*. (2010) also observed, among the five heuristics used by their participants, a persuasive intent heuristic. This heuristic is associated with 'advertising specifically and perceived commercial or persuasive intent more generally' (Metzger *et* al. 2010:432) and commonly led to negative assessments of the credibility of website information, in line with what was observed in my study in the cases of Karen, for whom advertising reduced dependability, and of Charlotte, for whom pop-up windows encouraging her to be distracted by a joke, or similar, were annoying and demonstrated a lack of sophistication on the part of the site creators. Both the expectancy violation and persuasive intent heuristics seem to be applied in concert on occasion.

In Section 5.3, I referred to the concept of epistemic deference. I return now to this notion from social epistemology to illuminate the way in which the reputation of *Wikipedia* as a source is, paradoxically, that it is dependable for its provision of a comprehensible introduction to a topic but not reliable enough to be cited, or included in a bibliography, because of students' perceptions that teachers consider it to be an unreliable source. Taraborelli (2008) offers two conditions under which we typically will display epistemic deference to external sources and I suggest that both are met when students use *Wikipedia*: one, when we do not have sufficient 'reliable knowledge on a given subject matter to ground a decision'; and, two, when to defer to an external source of information will give us 'a convenient, parsimonious *sufficient* solution to meet the requirements of a problem' (2008:195; italics in original). The paradoxical nature of students' use of *Wikipedia*, while hiding that use from teachers, is further consolidated when, despite *Wikipedia*'s provision of a foundational framework, students feel obliged to defer to the authority of the teacher, a strong element in the student's socio-academic context (here, quite likely because of the power of

the teacher to award grades). Without a strong grounding in their topic area (after all, the task has been set to develop student's knowledge), students have little option but to rely on an external source of information but, because of teacher's views and their power to have students respect those views, students feel comfortable about using a *Wikipedia* article as a map to the territory only. The convenience of the solution in Taraborelli's second condition links not only to my theme of convenience and pragmatism but also, through its allusion to the sufficiency of the solution, to satisficing, which is drawn from decision making theory and referred to in Sections 2.2.4 and 5.4. Faced with the plethora of information provided through the Internet students have found a convenient and satisficing but, above all, dependable way of building background knowledge. Their successful experiences of using *Wikipedia* give it the 'experienced credibility' that Tseng and Fogg (1999:42) use to refer to credibility 'based on first-hand experience', and thus built up through personal experiences over time. Another of Tseng and Fogg's (1999) types of credibility, 'presumed credibility', also plays a part here in that students have come to trust *Wikipedia* as a dependable source of introductions to topics and they thus have made general assumptions that it will play that role. Several factors combine to explain students' pragmatic epistemic deference to external sources of information.

Further to the notion of epistemic deference (referred to in Section 5.3 above), which Taraborelli (2008) considers operates in relation to judgements of the reliability of information, the author discusses what he terms a 'cognitive affordability constraint'. This label, essentially, describes a situation in which an information seeker employs epistemic deference when the cost of using other source evaluation processes would be higher; a pragmatic approach adopts the less cognitively demanding means of assessing the reliability of information. Taraborelli asserts that a cognitive affordability constraint is evident in situations in which the information seeker attempts to avoid 'computational explosion' (2008:200), which indicates a potential overtaxing of the cognitive processing system.

I suggest that participants in the current investigation found it less demanding of cognitive resources to judge the reliability of information sources by depending on their impression of writing style than to employ the more painstaking approach of examining the author's credentials in detail by, for example, assessing his or her qualifications, assuming that an author could be readily identified. Such a heuristic is explicable through Taraborelli's (2008) introduction of the modularity hypothesis to explain the cognitive processes involved in

responding to information. Although Seok (2006:348) contends that there is little agreement about the definition of 'modularity', particularly because it has been applied to several psychological or neurological phenomena, the author presents modularity as 'a property of a cognitive system', adding that a cognitive system is 'a physical mechanism that carries out a cognitive function'. Psychologists have stressed the functional and computational features of modularity (Seok 2006); a cognitive module may be defined as 'a specialized cognitive system that processes only a specific type of information', and which is 'an independent unit of a complex cognitive system' (Seok 2006:348). Taraborelli (2008:200) argues that

> If local inferential strategies can be identified that accurately yield a representation of the trustworthiness of a source, then we can say that the basic conditions are met for the selection of a modular solution to the problem of source evaluation.

5.6.2 Matching

Participants in my study compared information from one source with that found in another, in order to test whether the information in both could be considered reliable. I have called this process *matching*, and identified it as a major aspect of the building of knowledge. The process is, essentially, one in which information in a second, or subsequent, source is corroborated when it matches information that was found in the first source. I have thus used corroboration and matching synonymously in this report. (Data extracts related to matching behaviours are to be found in Appendix 4.7, column B. The data extracts are mostly representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

Two major types of corroboration were observed in the current study and are illustrated in Figure 4.7: (1) the matching of pre-existing knowledge (that gained prior to undertaking the current task) with newly found information; and (2) the matching of pieces of information that had recently been gathered for the purposes of the task in hand. In the first category (Type 1), participants used their prior knowledge, comparing it with the information that they came across when completing their tasks (Appendix 4.7: B.4, B.6, B.7, B.12, B.17, B.28, B.30,

B.33, B.34, B.35, B.36, B.37, B.38, and B.39). In the second category (Type 2), participants compared information from several sources in order to establish which was reliable (Appendix 4.7: B.1, B.7, B.8, B.9, B.10, B.17, B.23, and B.35). I was surprised that comparison of knowledge gained prior to the task with newly found information was the more common type of corroboration, as I had expected that corroborative behaviour would be common while using the 'immediate' pieces of information, that is, the ones with which the students were engaging for the purposes of completing the task that they were working on at the time. Initially, I explored the possibility of a connection between a high rate of usage of the first category of prior knowledge and the subject area in Study 1, for which students considered the assessment requirements to be less rigorous; I had speculated that students (the first 13 cases in Appendix 4.7) had depended more heavily on such prior knowledge in order to avoid the effort required to develop new knowledge from new information; however, this does not satisfactorily explain the phenomenon. Instead, it appears that the use of longer term knowledge is essential to building new knowledge; that is, the more freshly developed knowledge does not play as dominant role as I had thought. The pedagogical implications of this are raised in Section 5.8.

The heuristic used by several students when corroborating information was to rely on the most prevalent information (Appendix 4.7: B.2, B.11, B.15, B.19, B.21, B.22, and B.27). Four students reported finding agreement among the multiple sources that they consulted (see Appendix 4.7: B.5, B.18, B.20, and B.31); Sophie, however, finding contradictions between her found sources, put them aside and consulted other sources (Appendix 4.7, B.16). Karen seemed more comfortable with the lack of agreement that she observed among her multiple sources; a possible explanation is that she was more prepared to find contrasting views about the treatment of slaves by their masters in Ancient Rome, that is, she perceived the task to be more related to a discussion of opinions than of established facts.

Lily's Type 1 prior knowledge was in the form of her opinions, while for the rest of the students, it seems that prior knowledge was generally in the form of knowledge that they considered facts. Except for Karen, it appears that students' perception of their tasks was that they were required to find facts that could be tested for truthfulness by a process of corroboration. The contrast of this situation with the cases of Lily and Karen suggests that students' epistemological beliefs need to be investigated (see Section 6.3).

Two students compared information for reasons other than the type of corroboration discussed above, which was mainly for establishing the reliability of information. Jake's purpose for matching information was to identify gaps in his collected material (Appendix 4.7, B.25). In support of relevance priming (see Sections 4.4.3 and 5.4), Amber's purpose in comparison was to identify which sources were more detailed than others, indicating that students attempted to discriminate between broad, introductory treatments of topics and those that offer more depth on selected aspects of their topics.

The remainder of this section considers the similarity of 'agreement' and my term, 'corroboration'; and examines the information seeker's tendency to seek information that is consistent with existing beliefs, a tendency referred to as the 'confirmatory bias'.

Gil and Artz (2006) outline nineteen factors that influence trust judgements of users of Web resources; one of these is 'agreement', indicating agreement in content between a resource and numerous other resources. This is synonymous with my use of corroboration. Their use of the term, however, becomes more nuanced when they identify this factor as operating when 'a resource does not engender much trust in principle' (Gil & Artz 2006:567); surely this is my participants' stance toward *Wikipedia*, that is, attempting to allay their teacher-induced suspicion of the online encyclopaedia's reliability, they were motivated to seek corroborating sources.

About half of the participants in the Hargittai *et al*. study verified information by using information found on another site. Metzger *et al*. (2010:423) focused on the role of social information and social influence in the credibility assessments of their adult participants; the study found that some participants considered information, particularly that relating to politics and current events, credible when it matched their 'existing belief, opinion, or perspective'. Participants in the current study were seeking confirmation of their existing knowledge, which sometimes included their opinions but regularly also included more factual information. Metzger *et al*. (2010) offer an implicit caution when they discuss the selective exposure of Internet users to information that is consistent with what they already believe or know: when such selective exposure is used to judge credibility, information seekers may simply be reinforcing either their existing beliefs or any errors in information that they have

hitherto considered to be facts. While this is a highly likely situation, my data were not able to reveal whether this happened among the participants.

Another heuristic noted by Metzger *et al*. (2010) applies to my study: their consistency heuristic, which involves a validation process to check for consistency of information. Metzger *et al*. warn of the potential superficiality of such an approach when the user examines very few websites to demonstrate consistency of information. Although a more laborious heuristic than other heuristics they identify, the authors point out that the consistency heuristic requires less cognitive effort than the application of some traditional checklist tests, such as tracing details of author's credentials, identifying bias, and determining the recency of the information. Meola (2004) pleads for the abandonment of the checklist model of information evaluation in favour of using peer- and editorially reviewed sources, comparison of sources with each other, and corroboration with a selection of reviewed sources. Validation by cross-checking is not exclusive to the online environment and may happen across print and electronic environments, as was seen in my study when Chloe used information from books to corroborate information found on the Internet, underlining an assumption of the pre-existing reliability of printed books.

In order to understand matching behaviour, consider what decision making theory offers with respect to how decision makers respond to new information, whether found and used for relevance priming or relevance chaining purposes. When faced with new information, we tend to assign a lower weighting to any part of that new information that is different to what we already know and to favour information that coincides with what we already know. Once we have diagnosed what is occurring in a situation, we are subsequently strongly attracted to information that supports our initial diagnosis or conclusion.

'Several studies have documented our propensity to seek out information that confirms our existing beliefs rather than information that might disconfirm them' (Newell *et al.* 2007:35). Information consistent with our prior knowledge becomes amplified in importance, in the process of which we neglect information that does not match what we already know (Betsch 2005; Betsch & Haberstroh 2005). This is consistent with the structure building framework discussed by Gernsbacher (1990) (see Section 5.5). Because we are biased towards information that confirms our prior beliefs or that maintains the *status quo* of our knowledge,

this bias has been labelled the 'confirmatory bias' or, occasionally, the '*status quo* bias'. A clear definition of this bias follows (Haines & Moore 2003:265-266):

> The self-serving and confirmatory bias is the tendency to treat evidence consistent with one's preexisting beliefs or personal goals more favourably than inconsistent evidence and to make judgments and decisions accordingly.

The confirmatory bias also encompasses our tendency to be conservative about changing our diagnosis of a situation or our initial choice. While conservatism processes are not fully understood (Betsch & Haberstroh 2005), Svenson (2003) believes that post-decision consolidation plays a role: after a decision has been made, by paying particular attention to information that supports an initial choice, the individual's belief that that choice is a good one is reinforced (Svenson 2003). If the confirmatory bias were taken to its extreme, however, it is unlikely that we would ever learn anything new, but apparently the deliberative mode intervenes, activating new mental structures or substructures; the bias does, however, underline the need for us to exploit links between our existing knowledge and new information if learning is to take place. The confirmatory bias operates under the influence of the A-processing mode, our default mode; if the S-mode becomes involved, then the tendency towards confirmation can be ameliorated through the latter mode's deliberative consideration of new information, in situations where that new information is truly novel, or not consistent with one's pre-existing knowledge. Preference theory, an affect-based framework, 'predicts instant routine choice (conservatism) in status quo situations unless explicit deliberation goals have been activated before' (Betsch 2005:55). (For a full treatment of preference theory, see Betsch 2005.)

After the consideration of information that we believe will assist in the decision making process, we conclude which information will be the best for our purposes. In recognition-primed decision making (RPD; see Section 1.5), this is our diagnosis of the situation. Once we have reached that conclusion, or diagnosis, it appears that we pay particular attention to any other information that supports that conclusion or diagnosis, giving that diagnosis a primary status. Newell *et al.* cite several studies that indicate that decision makers 'tend only to search for information confirming their initial diagnosis' (2007:209).

Mood states are considered to guide us in relation to 'the type of processing strategy that should be employed to encode, interpret, and organize incoming information'; positive mood states appear to guide us to trust our intuitive feelings as we perceive the environment to be safe, whereas negative mood states suggest that we are entering a risky environment that may need a cautious approach (Gasper and Isbell 2007:97). Sinclair, Mark, and Clore studied participants' responses to two presentations of a persuasive argument and discovered that those in sad moods found the stronger argument more persuasive but that those in happy moods found both equally persuasive (reported in Gasper and Isbell 2007). When mood is not regarded as relevant to the particular decision making situation, however, it is not as influential. The influence of a happy mood will further be reduced when individuals are aware that they are accountable for their decisions or when they have been told unequivocally to be careful in their information processing (Gasper & Isbell 2007). If 'negative moods seem to reduce the preference for confirmatory information' (Gasper & Isbell 2007:104), such moods may predispose people to learning something new, rather than paying more attention to information that reinforces their views.

5.6.3 Adding

The *adding* stage of a student's ISP is the culmination of relevance judgements; it indicates clearly that the found information has been judged worthy of inclusion in a final information product, such as an essay or oral presentation, by virtue of its high relevance. While gathering information, participants were mindful about what they should use in their final product and took notes, directly from sources or from memory of what they had read, presenting these sometimes in tables with columns of various features or as 'dot points' (points in a bulleted list). While reading sources, participants attended to their emerging understanding, keeping in mind how they would shape collected information into a form that demonstrated their comprehension of the topic under investigation. Such forward thinking, about what their final product would be like, demonstrated strategic thinking, and offers an example of the way in which students regulated their effort and controlled the process of gaining knowledge that they could later exhibit. While participants were filtering during their adding behaviour, namely by making decisions about what to include and what to exclude, I intend filtering to refer to a behaviour that is generally an antecedent to adding. (Data extracts related to adding behaviours are to be found in Appendix 4.7, column C. The data extracts are mostly

representative samples; however, on occasion, the data provided may be the entire data coded in that category for a particular participant. Where a cell contains the note, 'No data categorised for this participant', no data in any of the data forms appeared to match that category.)

I have used *adding* to refer to instances of students considering information to be of sufficient relevance to incorporate, potentially, in the final product that they would submit to meet the requirements of the task. The remainder of this section explores the similarity of 'ending' and my term, adding; and considers the link between an integrative approach and adding, before examining the relationship between focus and adding.

Adding has superficial similarities with Ellis and Haugan's (1997) 'ending', which they describe as those activities associated with completing the ISP. Participants in their study were engaged in research and development, and ending activities included doing a last-minute literature search and resolving unsettled questions that arose during the ISP. Adding may also be related to Kelly's (2005:172) use of 'create', which she views as 'those behaviors the user engages in when creating original information'; I view adding as an activity that precedes creating, in that it is the final act of gathering relevant material, out of which original information will be created. I distinguish my use of adding from what Todd (2006:online) calls an additive approach (a 'progressive addition of facts', suggesting a steady accumulation of facts without concern for how they are related). The students in Grades 6 to 12 in Todd's study who adopted an additive approach also 'sorted, organized and grouped [facts] to some extent into thematic units'. All students in the present investigation, except one, displayed the integrative approach identified by Todd (the manipulation of gathered facts in several ways), and, like the doctoral students of Green and Macauley (2007:328), were engaged in the 'process of discovery and constructing meaning'. My use of adding is more closely allied to Todd's integrative approach.

Two factors may explain what stimulates an integrative approach. The first is consideration by the student of how the information will be structured in a final information product, because, at this point, thought is given to how collected information will be integrated to create a new product. Another factor that may stimulate an integrative approach is the presentation of a topic in pairs, as occurred in some cases in my Study 1; when students have to co-present, they have to clarify what they know, or at least identify the information that they have gathered, so that they can arrange how they will share the task of presentation.

Some students structured their information in oral presentations and essays with the intention of achieving a particular effect on the audience. Purposes, or aims, of presentations included the following: to arouse the audience's interest, entertain them, motivate them and even mobilise them to action. Examples are the use of an extract from the film, *The Crucible*, to enliven the presentation and to convey something of the hysteria surrounding the witch trials (Jenny); a short play written by the presenters (Lily and Noah); and 'we'll just structure it to kind, er, hopefully to get the audience to just kind of think about how it was so horrible and yet it happened again, and try and prevent it to not happen again' (Maria, Interview, Study 1). In contrast, in Brian's essay, the chronology of events in history guided his structure, with the intention of demonstrating the evolution of the pen.

The present study's data suggest two aspects to the structuring of information, both of which are related to focus: an emerging structuring, or categorisation, that guides searching, or becomes apparent during searching; and the structuring of information when the student considers its presentation. These two aspects are not mutually exclusive, and may be closely allied. There is, therefore, an association between focus, purpose, structure and presentation: the purpose of the presentation gives a focus both to the information search and the way in which the presentation is structured. In the case of Maria, the focus and the structure were intertwined with the purpose of the presentation: making the audience aware of the atrocities of genocides so that history would not repeat itself.

'Adding', as an activity forming part of 'knowledge building', warrants discussion for the termination that it brought to the decision making processes explored in this study, and for its function of making a sub-selection of highly relevant material from a selection of material already considered relevant. When students took notes, they confirmed their belief in the relevance of the information, even though they may later have had, for example, to omit some material to meet a word limit or to suit the focus of their final product. Joseph (2006:36) believes that questions that require students to 'compare and contrast, synthesize, analyze, and evaluate', as in the tasks in the present investigation, assist in the development of metacognition through the thinking processes they entail. Such task requirements encourage the processing of found information by requiring that the student make decisions about what to do with it. Although possible to find sources that offer comparisons and contrasts, syntheses, analyses, and evaluations in various topic areas, from which students may be

tempted to copy and paste, it is more likely that such task requirements will discourage plagiarism. An assignment designed in this way expects students to think about what warrants being added to their final information product.

I use 'focus' to mean any narrowing down of a topic to a particular aspect or set of aspects to which the student has elected to pay attention (as opposed to focus on or engagement with a task, which is part of resource management or effort control, although the former focus may give rise to the latter type of focus). The positive impact of developing a focus is underlined by Tanni and Sormunen (2008:907) 'The formulation of a focus can be thought [of] as a change in information behavior attributable to fundamental transformations in the way of knowing about a topic'. Many students demonstrated that they had developed a focus and, in the light of the comment of Tanni and Sormunen (2008:907) that follows, could be thought of as having been intrinsically motivated and oriented to the process: 'The failure to formulate a focus can … be linked to extrinsic motivation and product orientation'.

Part of each task in the current study was a word limit or a time limit. Such a limitation compelled participants to consider what could be added and what needed to be left out. While notes could be added at will, the length of the final information product had to be controlled. When having to delete material that he had written in order to fulfill a word limit, Daniel (Interview, Study 1) felt frustrated 'because I've got to get rid of an idea that I thought, initially, was quite good'. Robert was annoyed when he found relevant information on *Wikipedia* that he felt could not be used because it was not supported by references.

Having gathered what they felt was sufficient material to complete the information search task, students could not include all the material and so considered selections to include in their final products. This was a difficult process requiring the discarding of material on which time and effort had been spent but that could not be included. Frequently, word limits imposed the discipline of making a sub-selection from the selection of material that students had available. A word limit appears to have the effect of compelling the student to adopt a focus or to refine an existing focus; thus, it may be argued, a word limit results in a more tightly and better focused product, having forced some final relevance judgements. Such behaviour is an additional dimension of relevance judgements in which participants made a selection of highly relevant material from what they had previously judged to be relevant material.

Bowler's (2010) study of the role of curiosity in the ISP reveals a tension in students between wanting, on one hand, to give in to their curiosity and to explore a topic and, on the other hand, to curb their curiosity in order to meet a deadline for the completion of a task. This has a connection with relevance in that students cannot use all relevant material, no matter how interested they may be in pursuing it, because of limited time for submission of the finished product. In my study, Victoria thought of her interest in reading more than what was required by the topic as a drawback. In the Bowler study, P4 was aware that she needed to fulfill the task requirement of drawing from a variety of sources and therefore could not become 'bogged down' by any single book that may have interested her. Bowler (2010:1340) makes the connection with relevance explicit: 'Reigning [sic] in curiosity in the topic related to decisions about relevance and usefulness'. Maintaining attention on information relevant to the student's focus, and on an amount of information manageable in the timeframe, challenged students in both the Bowler and present studies.

Some aspects of adding behaviour described here clearly intersect with filtering behaviour and may be considered extensions of relevance judgements in that they require a more finely tuned judgement of what should be selected from the material already selected. Adherence to word limits is a challenging aspect of task completion for students. Word limits for essays and time limits for presentations do not only make life easier for assessors, or markers, and audiences; they also force a focus that may encourage students to present a final product that contains a more careful selection of relevant and potentially better organised information than otherwise would ensue. They are, however, frustrating to students who feel the need to demonstrate all that they have learned by adding most of the relevant information they have gathered.

5.7 Grounded theory of students' judgements of relevance and reliability of information

In this section, I present a theory, grounded in the data of the study presented and discussed above, of the ways that students evaluate information, focusing on their relevance and reliability judgements. The theoretical statements offered should be read in conjunction with Figures 4.9 (a) and (b), as they emanate from the models presented in those figures. Appendices 4.3 to 4.7 offer supporting data.

Theoretical statement 1: Convenience and pragmatism

Students take a convenient and pragmatic approach to information search tasks. They consider the research process to be unchallenging, and occasionally seek the least challenging path to task completion. Students depend on the relevance rankings of search engines, favouring results that occur early in a set, and do not demonstrate any understanding of the methods used by the search engine. They base decisions about the relevance and reliability of information on metadata such as titles, snippets, and URL elements; these heuristics save the effort of accessing the full resource. Some decisions about reliability are intuitive, although they may be based on past experience. Students depend on the most prevalent information to assist their relevance judgements, and to decide on the main points of their topic area.

Theoretical statement 2: Search for an overview

Students are strongly motivated to find an overview of their topic of interest; this provides a framework for learning from information sources found later in the information search process. Early adoption of information that provides an introduction to a topic, and early adoption of information at hand, generally, may prevent students from exploring their topics more deeply, by denying them the opportunity to develop their own mental model of the information in the topic area.

Theoretical statement 3: Incidental nature of establishing reliability

Reliability of information is established incidentally in the process of finding sources that offer information that accords with that found in earlier sources. Students believe that teachers

consider *Wikipedia* to be an unreliable source; although this belief strongly influences students' perceptions of its reliability, it does not prevent their use of it, particularly for its ability to provide the overview referred to in Theoretical statement 2.

Theoretical statement 4: Prior knowledge

Prior knowledge plays a leading role in both relevance and reliability judgements of students. Such prior knowledge is in the form of information remembered from an earlier experience and also in the form of preconceived notions of the potential for a particular genre, or particular information provider, to offer relevant and reliable information. The reputation of a source's reliability appears to be based on a generalised personal belief; whether such a personal belief is an outcome of socialisation or based on personal experience is often unclear.

Theoretical statement 5: Process of building knowledge

Students build knowledge in a process of filtering, matching and adding. Their judgements of the relevance of information form part of the process of filtering information. They rarely judge the reliability of information in an explicit way, even though they claim to use methods of doing so. Matching employs their judgements of relevance and reliability simultaneously: when two sources of information are found to be relevant, students coincidentally consider both to be reliable as a result of their corroboration of each other. When students consider information to be relevant, some test whether it suits their personal focus, some sort it into categories, but most readily add it to their finished product with little apparent discrimination. Few students explicitly test information for its reliability before incorporating it in their finished product, relying instead on impressions of trustworthiness. When questioned about how they establish reliability, students offer a set of heuristics that appear to be applied intuitively. Some of these heuristics have been inculcated by teachers and may not be based on students' personal experiences of interacting with information sources, as indicated above.

5.8 Pedagogical implications of research findings

This section considers some implications of the current study's findings for teaching practice. These implications are: that a checklist of features to gauge the reliability of a piece of information is not consonant with naturalistic decision making; that information adopted because of its early appearance ought to be questioned in later stages of the ISP; that prior knowledge should be harnessed more explicitly in the learning process; and that background knowledge should be developed from more than one source.

The current study's participants used corroboration between one piece of information and another to establish the reliability of the information. Such an approach is based on the comparison of one source of information with another and is an inter-source approach, that is, the participant evaluated information in one source on the basis of its correspondence with that in another source. In contrast, the application of a set of standards to a single piece of information, in which the internal features of that piece of information are judged, may be called an intra-source approach. The latter approach appears to be based on classical decision theory and does not reflect the naturalistic decision making process described in my report. Meola (2004) has criticised the use of guidelines that focus on internal properties of a website for not promoting critical thinking, and for offering inadequate evaluative questions. Like Meola (2004), I want to abandon the checklist. My study offers empirical support for Meola's opinion. Tasks for students should be designed to incorporate explicitly the comparisons that students have made between pieces of information.

The current study found that participants relied heavily on information found early in the ISP, an approach that runs the risk of missing relevant information through premature closure of the information search. In order to discourage the practice of following the least challenging path by appropriating information found early in the ISP, teachers may wish to design tasks that require students to compare information found early in the ISP with that found later. This could be achieved, for example, by asking students to summarise the information found from websites retrieved by using one search engine and comparing that summary with a summary of information from websites that were found by using a different search engine. Such a strategy, like that in the foregoing paragraph, has the advantage that contradictory information may be uncovered, and so the way in which the student has reconciled such contradictory information may also form part of the requirements of the task.

This study indicates that knowledge held by a student prior to undertaking a task is commonly drawn upon when considering new information sources. Students used prior knowledge when comparing information from one source, or from long-term memory, with information found in a subsequent source. Such a comparison is central to relevance chaining, in which students draw from memory some aspect of knowledge that they have previously learned. Such knowledge may have been quite recently learned or may be from a much earlier learning experience. Brainstorming, concept mapping (and other graphic organisers, such as outline templates and Venn diagrams), and even note taking, help students to make links with their prior knowledge. Note taking facilitates students' connection of old knowledge and new information, with the effect strongest when material is moderately unfamiliar (Peper and Mayer 1986). In Herring's (2006) report on fifty-two Year 8 students in a Yorkshire school, brainstorming and concept mapping aided students to focus on their prior knowledge. Chung and Neuman (2007) claim that use of an outline template and concept maps reduced cognitive load for students when organising their information. Brooks and Shell (2006) also point to the positive influence of concept mapping on student achievement. The incorporation in students' tasks of requirements that include such techniques for making links with prior knowledge more explicit may be useful for students to develop greater awareness of the metacognitive processes of their learning.

In completing information tasks in the current investigation, students used multiple sources. Such a practice appears to have been an expectation of teachers that was sometimes stated explicitly in task requirements. Tasks designed for students to consult multiple sources increase the possibility of students having to confront contradictory information. Tasks may require that students continue to search for information that is contradictory and that they explain how they reconciled such contradictory information. This would have the combined effect of students not only prolonging their information search, rather than practising 'satisficing' behaviour and stopping at 'good enough', but also developing and articulating awareness of how they develop knowledge. Grappling with opposing points of view is likely to lead to students developing richer understandings of their topics of investigation.

Participants in the present study showed a strong need to locate an introductory treatment of their topics. While their reliance on *Wikipedia* to provide such an overview is considered a dubious practice by teachers, more on anecdotal than empirical grounds, it does suggest that students could be encouraged to consult a wider variety of resources that provide

introductions. Other encyclopaedias and print resources published to meet such needs are able to supplement *Wikipedia* articles, and tasks that require students to consult multiple sources that provide overviews of topics could be devised. Such a requirement could form part of the preliminary stages of an assignment and its fulfilment would demonstrate the breadth of topic understanding developed by a student before he or she chooses issues or subtopics within the major topic on which to elaborate, and thus develop further understanding. All learning tasks are bound by time and the information processing skills of students. Inevitably, then, satisficing behaviours will be evident. The approach described here, however, offers the possibility of using limited time to access a wider range of information sources and thus encourage a broader understanding of a topic area.

In order to reflect the natural ways in which students make decisions about which information is relevant and reliable, comparisons of one source of information with another should be encouraged, rather than the assessment of a single source of information against features that may include the author's credentials, the comprehensiveness of the source, and the author's objectivity. Prior knowledge of students should be more explicit in task design, and students should consult multiple sources of topic overviews. Tasks may be designed to encourage students to go further than initially found information and to investigate a topic more broadly.

5.8.1 Recommendations for policy and practice

Students do not appear to be challenged by information search tasks that require them to find information on a topic and present their findings. There appears to be little or no difference between the approach to such a task of a student at a lower level and the approach of a student at a higher level; that is, the skills required to complete the task do not develop in sophistication. A Year 5 student, I suggest, could, as readily as a Year 11 student find and present information about the Falklands War, completing the task using an engrained process and without fully engaging in it. Students have become bored by the process (essentially, simply going through the motions) while teachers appear to think that allowing them to select topics of personal interest will bring engagement through the variety of content areas students are able to explore. I recommend, therefore, that schools develop a policy of providing richer tasks for students. The work of Kuhlthau, Maniotes and Caspari (2007) provides an excellent guide to achieving this through adopting a guided inquiry approach. The implementation of

such a policy would see students engaging in authentic problem solving that has an association with the real world, rather than what appears to be learning content for its own sake.

I encourage teachers to take an active role in students' interactions with information, rather than adopting what appears to be a 'set and forget' approach in which they set a task for students, give some very broad guidance (such as, not to use *Wikipedia* because it is unreliable), and then forget about the task until they have to assess the students' finished products. Such an approach assumes a level of independence that many students do not have. I have made some specific recommendations in Section 5.8 above that would bring more focus on process; in general terms, a more critical evaluation of sources by students is required, where students make their thinking more explicit, rather than appropriating anything that is relevant for inclusion in their finished products. However, practice must go further: students' information searching must have a broader purpose than finding and presenting information. The process should also include opportunities for students to wrestle with contradictory information, which is commonly found when seeking information. As we use information to make decisions in life, we should be teaching students to weigh up the consequences of drawing conclusions from information. In a guided inquiry approach, under the guidance of a team of teachers and teacher librarian, 'the content of the curriculum is connected to the student's world through careful planning and adaptability' (Kuhlthau *et al*. 2007:5). The dimension of decision making, an important skill in life, is neglected when information search tasks do not require students to come to a decision, justify it (using the knowledge gained from information available), and indicate what link such a decision has with his or her life.

5.9 Conclusion to discussion of themes

Participants in the present investigation had developed pragmatic responses to tasks set by teachers. Their judgements of the relevance and reliability of information were influenced by their perceptions of the constraints and enablers in their socio-academic environment, such as what their teachers considered reliable sources, which behaviours would earn them the desired grade, and their beliefs that some sources enjoyed a reputation for dependable information. The participating students had developed distinct routines for approaching information search tasks; these included using the *Google* search engine, relying heavily on its relevance rankings but using a set of pre-access judgements of returned results to determine which full sources were likely to meet their needs; using *Wikipedia* articles to provide an introductory overview of their area of investigation; and seeking information that would corroborate information already found. They thus leveraged resources at their disposal, and familiar to them from related experiences in their pasts, to complete tasks in the most efficient and effective manner they knew. An information search task typically provided the stimulus to which students responded in routine ways, given their associations of success arising from strategies applied when undertaking similar tasks in the past.

The current study shares some of its findings with several other studies, the most notable of which are outlined in Table 5.2.

Studies	***Finding(s)***
Ellis & Haugan (1997)	Notion of 'surveying' synonymous with mine of 'relevance priming'
Gil & Artz (2006)	'Agreement' as a factor influencing trust judgements, and which I have termed 'corroboration'
Hargittai *et al*. (2010)	Participants considered URLs with '.edu' and '.gov' in them more credible, and half used the process of corroboration that I have described
Hofer (2004)	Identified comprehensibility of material, and length of source as criteria for selecting sources for use
Metzger *et al*. (2010)	Source reputation, and author's mastery of a topic, style of writing, spelling and grammar, and level of detail in treatment of topic influenced users' perceptions of credibility; *Wikipedia* used as an introduction to main points of topic
Vakkari (2001)	Noted need among participants to find an overview to their topic, although not specifically from *Wikipedia*

Table 5.2: Studies sharing their findings with the current investigation

Trustworthiness of information in the present investigation was gauged by participants in a largely intuitive way, from impressions of authors' credentials, which were based on authors' writing style, the extent of detail in their treatment of the topic, and the level of professionalism conveyed by the design of the website offering the information. What appears to be intuition is likely to have been based on prior experience, either direct or based on hearsay evidence gathered over students' academic careers, and may instead be experiential wisdom.

Behaviours of participants have much in common with those of successful readers; these include retrieving and using prior knowledge, determining main points, and synthesising information (Joseph 2006). As such, the participating students demonstrated their success as self-regulated learners with effective strategies. They attacked their tasks confidently, implicitly believing in the efficacy of their heuristics, a belief supported by assessment results. Both their ability to monitor their learning, and reflect on it, suggest high levels of metacognitive awareness. Corrigan (2001:38) refers to metacognition as the use by learners of 'executive processes of control over their learning' and includes, in these processes, 'choosing, coordinating and applying specific learning skills'. Participants employed not only procedural knowledge, in the form of their learning strategies, but also developed declarative knowledge when they built knowledge, basing it on their prior knowledge (gained, for example, from outside the school environment, from studies elsewhere in the curriculum, from a prime source, or another source independently located).

A requirement in tasks to consult multiple sources of information appears not only to support students to make connections with prior knowledge but also to encourage the operation of the deliberative system of judgement, motivating the information seeker to move beyond a source that may, under the influence of the more intuitive system, be appropriated because it is the first in a list of results that looks sufficiently relevant to meet an information need. Rather than participants' perception that teachers do not approve of *Wikipedia*, allegedly because of its dubious reliability, causing them to steer clear of the encyclopaedia, students have adopted the general framework of *Wikipedia* articles to develop background knowledge. Without the requirement to refer to more than one source, students would probably have stopped their search at the online encyclopaedia because it offered the first relevant source. Had this occurred, the corroborating influence of information in subsequent sources would not have

been activated, with the attendant possibility that reliability judgements would have become even more of a secondary consideration to the primary judgements of relevance used in decisions about which sources to use.

My discussion has attempted to consider more broadly the applicability of decision making theory to the information search and use behaviour of participants than those studies that focus on very specific aspects (such as satisficing, bounded rationality, and the principle of least effort), although it does not purport to be an exhaustive consideration of decision making theory in relation to the behaviour in the present study. Data were interpreted in the light of the generally accepted dual systems of intuitive and deliberative decision making. Some key concepts from decision making that are supported by my study are: the role of primacy; the dominance of a preliminary choice; the appropriation of the first relevant solution; the operation of a recognition heuristic; ecological rationality; the effect of a confirmatory bias; loss aversion; and the application of a stopping rule. Others for which there is less strong support, but which were easily adapted for the current investigation, were anchoring, and attribute substitution. The study offers clear suggestions that secondary school students, when making decisions about the relevance and reliability of information, behave in ways that accord strongly with the major tenets of decision making theory.

CHAPTER 6: CONCLUSION

This chapter summarises some aspects of methodology, noting the strength of think-aloud data to support interview methods; and situates the study's findings in relation to participants' relevance and reliability criteria in the work of two major groups of researchers. It also considers the significance of the study's findings more broadly, outlines a selection of the study's limitations, and suggests areas of future research.

The study reported here set out to investigate the relevance and reliability criteria applied to information sources by a group of secondary school students from a school in south-eastern Australia. The students were in Years 9 to 11, and were aged between 14 and 17 years. The student volunteers were engaged in tasks that are commonly referred to as research projects or assignments. Tasks of this nature require students to find information, largely independently, from a variety of sources on a particular topic, often chosen from a selection offered by the teacher; students synthesise the information and demonstrate their learning in such finished products as an essay or an oral presentation. From my observations as a teacher librarian in schools for around two decades, I have concluded that there is considerable emphasis in such tasks on the product, and that little or no direct help is given to students that will assist them with the processes required to reach the destination of their product, although I do not mean to ignore the invaluable one-to-one help given by teachers to individual students who ask for help and who are sufficiently organised to prepare drafts for teachers to inspect and on which to provide feedback. My investigation has uncovered some important aspects of these processes that may inform teachers' guidance of learning. The emphasis then is on the learning strategies used by students with a particular focus on how they judge information sources to be relevant and reliable enough to use in their final products.

A literature search revealed that while tertiary students were regular participants in the research work of the type proposed, very little research was with secondary school students as participants (see literature review, Chapter 2). Of the research that has taken place with secondary school students, the proportion of studies of reliability, regularly referred to as credibility, is larger than the proportion of relevance studies. Two groups of researchers in the field of secondary students' perceptions of the reliability of information are Walraven, Brand-Gruwel and Boshuizen (2009), and Francke, Sundin and Limberg (2011); the former investigated Dutch students while the latter investigated Swedish students. It is appropriate to add the findings from another nation's students to these two studies.

My findings confirm those of Walraven, Brand-Gruwel and Boshuizen (2009) in relation to students' use of titles, summaries (snippets), and connectedness to topic as prime indicators of relevance. With respect to the same study's findings of strategies to evaluate reliability, my study found a similar picture: corroboration of one source with another; awareness, but little explicit application, of reliability criteria; relevance of information apparently weighted more heavily than reliability; language and writing style influencing perceptions of credibility; and usage determined by ready understandability of the information. The Francke, Sundin and Limberg (2011) study reveals some information evaluation criteria that overlap with those found in my study: authorship, references, applicability, and rhetoric. Some criteria found by the same authors were not seen in my study: currency (probably because few topics in my study demanded current information); and social commitment (the participating Swedish students had considered information sources related to nuclear power in Europe and thus the bias and level of altruism of the organisation providing the information was a consideration, unlike in my study). I have referred above (in Section 5.9) to other studies with which my study shares findings.

My study was based on a naturalistic approach in which participants were not set specific information sources with which to interact but were allowed to engage in and talk about a current or recent task. These self-selected tasks permitted students to search for and use information sources that they had discovered independently. I used semi-structured and structured interviews to investigate students' experiences of their information search tasks. In the first of three small-scale studies, use was also made of journals kept by participants and responses to simple questionnaires. I subsequently used think-aloud protocols, in which students verbalised their thoughts while undertaking a task. I considered the think-aloud data to be the strongest because they were not dependent on self-reported data, such as were collected through interviews, journals or questionnaires, and were complemented by a report given immediately afterwards, in a strategy considered by Ericsson and Simon (1993) to be effective because of the freshness of the experience held in short-term memory.

My study was influenced by grounded theory, in which the emphasis is on the generation of theory from data. As a first step in data analysis, I categorised segments of data, focusing on any data that revealed aspects of students' information search process (ISP). I subsequently focused on the relevance and reliability criteria employed by participants before examining the processual context in which such criteria were applied.

6.1 Significance of findings

The findings of the current investigation are significant for their contribution to our knowledge of how secondary students approach information search tasks, particularly their judgements of the relevance and reliability of information, identified as a gap in the literature. Rather than focusing on the effect of teaching strategies, the study has examined the spontaneously occurring evaluative behaviour of student participants; think-aloud data accompanied by video recordings of online behaviour, as well as self-report data, were used. The study's findings will also be of interest to tertiary educators who want to gauge the level of preparedness of students for post-secondary courses and to develop courses that improve students' learning outcomes. The study makes links between information behaviour and decision making theory, and has attempted to go further than the satisficing and bounded rationality aspects of such theory, which have been evident in earlier studies.

The present study contributes to the body of knowledge about the information seeking and searching behaviour of adolescents. Specifically, it increases our understanding of how students in a secondary school approach tasks that require that they search for, make sense of, and present information in order to demonstrate their learning about a topic. Even more particularly, the study offers findings about Australian students, for whom the information search task is a common experience.

My investigation has captured the spontaneous evaluation of information by students. It achieved this through the use of think-aloud data. Bråten, Strømsø and Salmerón (2011) suggest the use of such a method as an attempt to separate the information evaluation behaviour of students that may be attributed to teaching strategies (recent, presumably) from that which they would demonstrate without the influence of recent guidance on how to evaluate information. This approach is more likely to have uncovered the enduring, embedded habits of students when tackling information search tasks than behaviours that they may attempt for the immediate task, and for which a teacher has given guidance that may be construed by the student to apply only to that particular task.

Tertiary educators who wish to gain an understanding of the level of preparedness of students emerging from secondary education are likely to find the current report of interest. Knowledge gained from the study may provide a useful basis for the further development of students' information literacy. Guidance may then build upon students' existing skills in interacting with information. Given that much of the assessment of tertiary students' academic performance is based on the writing of papers that often represent a synthesis of information gathered from various sources, and the presentation of an argument based on the synthesised information, clear understandings of how learning takes place through such tasks is of considerable interest.

The present study considers students' judgements of the relevance and reliability of information in the light of the tenets of decision making theory. While prior studies have considered such notions of satisficing and bounded rationality, my investigation has attempted to go further. It has thus also considered the adoption by individuals of solutions that are found early in the decision making process, discussing this in the context of the primacy of first-found information; the dominance of the recognition heuristic, in which the participants' familiarity with *Google* and *Wikipedia* were underlying factors in their habitual return to these sources; and the role of prior knowledge in decision making, which was discussed particularly in relation to relevance chaining. Satisficing, and ecological rationality (connected to bounded rationality), were also observed in the present study. Other concepts from decision theory supported were: the effect of a confirmatory bias; loss aversion; and the application of a stopping rule. Furthermore, anchoring and attribute substitution were also evident in the current investigation, although less strongly than the former concepts.

A selection of implications of the findings for educators was outlined in Section 5.8 above. These may be considered a starting point for the development of programs that take advantage of the naturalistic decision making strategies demonstrated by participating students and which seek to ameliorate some of the effects of such strategies, that is, that invoke a more deliberative decision making process that entails metacognitive intervention in what otherwise would be intuitive processes.

My study has paid attention to predictive judgements, the set of judgements identified by Taraborelli (2008) as probably more important than evaluative judgements, which are aligned to intra-source judgements that are based on the source's content and credentials. In other words, the current investigation has considered those judgements made about a source before it has been accessed. This stage of information behaviour is one that the traditional checklist of criteria to apply to the source, once accessed, tends to overlook.

The present study's significance lies in four areas:

- it contributes to our knowledge of how secondary school students approach tasks that require them to consult multiple sources and to build demonstrable knowledge from them;
- it captures the natural behaviour of students, as far as that is possible in a research setting;
- it offers tertiary educators a starting point from which to develop students' information and research skills; and
- it extends the connections made in the literature between information behaviour and decision making theory.

6.2 Limitations

I have identified at least one limitation to my study: the full range of the participants' ISP may not be evident, thus not offering a full picture of their relevance and reliability judgements.

A major limitation of the study is that the strongest data, in the form of think-aloud data and video captures of online behaviour, offered only a segment of the ISP for investigation. This did not present an opportunity for investigating such phenomena as changes in relevance and reliability criteria over the course of the ISP. Nevertheless, the less strong source of data, in the form of self-reports made during interviews, did present opportunities of this nature as these data covered a wider range of stages of students' ISP. Self-report data did not provide instances of student participants actually examining author's credentials, although they claimed to do this; nor did think-aloud and video data provide instances. It should be noted, however, that what students meant by scrutinising authors' qualifications may have differed from an investigation of authors' academic qualifications; in fact, it appears that writing style was used by participants as an indicator of whether the author was competent to write on his or her subject (see Section 4.3.2.3) rather than, say, possession of relevant tertiary education. The study cannot be said to have ranged over the entire ISP in a comprehensive manner but rather to have drawn on a participant-selected sampling of activities within the ISP.

A limitation identified is that segments of participants' ISP have been investigated, rather than taking an all-encompassing view that would have required significant resources to research, possibly requiring a team of researchers.

6.3 For further study

I have identified six areas that may be fruitfully explored in future research:

- a quantitative survey of students' practices in relation to my study's findings;
- the influence of cognitive development on strategies for evaluating information;
- ways in which students develop those of their judgements that are based on proximal information;
- the role of affect in judgements;
- a more nuanced look at students' use of prior knowledge; and
- the part played by their epistemological beliefs in task perception, which subsequently influences the type of knowledge that they perceive that they are required to demonstrate.

It may be possible to follow up my study with one in which, say, several statements are given to a representative sample of students to rate the extent of their agreement with each; for example, a survey instrument may be used in which a student is asked to rate, on a seven-point scale, his or her level of agreement with statements such as 'I use *Wikipedia* to give me an introduction to my topic', '*Wikipedia* is a reliable source', 'When I find information in one source, I check that information with information in another source', and 'I trust websites that have .org in their URLs'.

While the strategies used by the student participants in my study relate to 14- to 17-year-olds, the question arises of whether such strategies would be evident in younger, or older, students. Research in response to this would require an examination of the association between the stage of cognitive development of the student and the appearance of evaluation strategies. An attempt could be made to associate sets of strategies with particular stages of cognitive development of participants.

Another question that may benefit from further exploration relates to the use of proximal information, which Taraborelli (2008) considers useful in making predictive judgements. While the present study found, for example, that the suffixes of URLs and the names of websites have an influence on whether students use the related sources of information, it may be useful to explore the factors that lead students to believe that their heuristic judgements of

proximal information are dependable. While there is some indication that teachers' views demonstrated in their guidance, about which URL suffixes are more reliable than others, influence students' predictive judgements, there is scope to investigate other heuristics, and also to tease out the process by which students develop such beliefs.

While intuitive judgements hint at a role for affect, it is not clear whether affect influences information evaluation behaviour. Similarly, temperament, with its associated preferences for information processing, may have a role in such behaviour, yet remains open to further investigation. Examples of research questions that arise are: 'Does the typical information search task in schools suit students with particular temperaments?' and 'What role does mood play in information evaluation, and do changes in mood states influence the way in which information is evaluated?'. A consideration of the areas suggested would address two of the three learner dimensions presented by Tanni and Sormunen (2008) in their research dimensions, affective mental states and learning styles (see Figure 1.3), rather than address only their third, cognitive mental states, as I consider my study has done.

The role of prior knowledge in students' building of knowledge has been discussed above, both as part of relevance chaining, and of matching (see Sections 4.4.4 and 4.4.5.2, respectively). The use of prior knowledge may be a profitable area for further research, perhaps through an examination of the role played by pre-existing knowledge, comparing it with that built during the course of the task in hand. In this way, educators would gain an insight into the ways in which students incorporate knowledge that they hold before embarking on a task as well as the ways in which they use information to build knowledge while pursuing the task. Such research is also likely to uncover the level of metacognitive awareness that students have of their learning processes.

My data suggest a dichotomy in students' perceptions of tasks: they perceive them as essentially requiring that they produce either facts or opinions. This seems to be an oversimplification of task requirements that overlooks the variety of opinions that may exist of the same phenomenon, such as an historical event; that is, that opinions about factual events may be held. The epistemological beliefs of secondary students may warrant research; Fitzgerald (2005) contends that epistemological orientation influences an individual's

approach to information evaluation. The work of Tu, Shih and Tsai (2008) was with school tudents, a group whose epistemological beliefs are not commonly researched; tertiary students are more likely to be reported as participants in such research (see, for example, Hofer 2004; Paulsen & Feldman 2005, 2007; and Whitmire 2003, 2004). I speculate that whether students perceive a task to require facts or opinions is related to their epistemological beliefs; that is, that they interpret tasks to necessitate the production of a certain type of knowledge based on particular sets of information sources. Such research, then, would consider the interaction between students' epistemological beliefs and their perceptions of task requirements. Related to such a research direction is research into the effect of teachers' articulation of task requirements and students' interpretations of these. Meanwhile, there are indications from the present study that students need guidance that will help them understand the biases of factual information.

In summary, I have suggested that further study be undertaken in the following ways:

- a quantitative study that tests the degree to which other secondary students exhibit behaviours that have been reported here;
- a study that examines the association between cognitive stage of development of students and their use of information evaluation strategies;
- a study that examines how students develop and come to depend on evaluative criteria, particularly those used in relation to proximal information about sources;
- an investigation of the role of affect in students' evaluation of information;
- research into the part played by prior knowledge, which may be thought of as both long-term and short-term prior knowledge, or pre-existing knowledge and knowledge developed 'on the fly', respectively; and
- a study of the influence of students' epistemological beliefs on their perceptions of task requirements and subsequent evaluation of information used in the process of completing such tasks.

Other studies that arise less directly from the current study include whether level of sophistication of students' evaluation strategies is correlated with academic achievement.

6.4 Concluding statement

I have presented an interpretation of the participants' interpretation of a selection of their experiences. The roles of teachers and students have been illuminated, particularly students' reconciliation of perceived expectations of teachers with their pragmatic solutions to completing tasks. The way in which learning is shaped has been revealed.

Educators appear to have assumed a rational basis for decision making. The closest suggestion of conformity to a classical decision making model is participants' consideration of authors' credentials but these are inferred from surface features, specifically writing style. Heuristics have supplanted an in-depth investigation of the educational background of an author, rendering indirect the connection to a deliberative approach.

While think-aloud data gathered for this study revealed that participating students spontaneously consider relevance and reliability criteria, some participants may have benefited from a practice session in thinking aloud. A few students allowed lengthy periods of silence to elapse; in future, I would examine the feasibility of introducing a tone every 30 to 60 seconds, preferably activated only if silence has been detected, to remind students to express their thoughts. Additionally, a more thorough analysis of both the think-aloud data and the video screen capture data may be undertaken, comparing those sets with interview data, in order to determine more clearly the extent to which interview data, representing participants' reported experience, were more or less reliable than the more direct data.

I have demonstrated to myself, as a teacher, that expecting students to follow a checklist of criteria (described by Gasser *et al*. 2012:10 as 'established adult-normative criteria emphasizing credibility, accuracy, and authority') runs counter to natural ways in which decisions about reliability are made. More productive ways for students to demonstrate their vetting of information are those adopted by this study's participants. The study has shown that students are aware of information reliability issues; I suggest that such issues can be explored, using the students' language, and that their awareness provides the foundation for developing further understanding. Recognition of untrustworthy information will lead to more effective learning and, ultimately, citizens better informed to function in a democratic society.

My study is intended to contribute to our knowledge of how secondary school students interact with independently sourced information. While students' judgements of the reliability of information appear to be more popular currently than studies of their relevance judgements, apparently because of the increasingly popularity of free Web-based sources and associated concerns emanating from educators, the intersection between these two sets of judgements is also worthy of investigation.

REFERENCES

Adams, S., de Bont, A. & Berg, M. 2006, 'Looking for Answers, Constructing Reliability: An Exploration Into How Dutch Patients Check Web-Based Medical Information', *International Journal of Medical Informatics*, vol. 75, no. 1, pp. 66-72.

Agosto, D.E. 2002, 'Bounded Rationality and Satisficing in Young People's Web-Based Decision Making', *Journal of the American Society for Information Science and Technology*, vol. 53, no. 1, pp. 16-27.

Albion, P. 2007, 'Student Teachers' Confidence and Competence for Finding Information on the Internet', in *Proceedings of Society for Information Technology & Teacher Education 18th International Conference (SITE 2007)* (San Antonio, Texas, March 26-30), AACE, Chesapeake, VA, pp. 1244-1249.

Alvesson, M. & Sköldberg, K. 2009, *Reflexive Methodology: New Vistas for Qualitative Research*, 2nd ed., Sage Publications, London.

Anderson, C. J. 2007, 'The Functions of Emotion in Decision Making and Decision Avoidance', in *Do Emotions Help or Hurt Decision Making?: A Hedgefoxian Perspective*, Vohs, K.D., Baumeister, R.F. & Loewenstein, G. (Eds.), Russell Sage Foundation, New York, pp. 183-201.

Anderson, T. D. 2006, 'Studying Human Judgments of Relevance: Interactions in Context', in *Proceedings of the 1st international Conference on Information Interaction in Context* (Copenhagen, Denmark, October 18-20), IIiX, vol. 176, ACM, New York, NY, pp. 6-14.

Aula, A. & Nordhausen, K. 2006, 'Modeling Successful Performance in Web Searching', *Journal of the American Society for Information Science and Technology*, vol. 57, no.12, pp. 1678-1693.

Bade, D. 2007, 'Relevance Ranking is not Relevance Ranking or, When the User is not the User, the Search Results are not Search Results', *Online Information Review*, vol. 31, no. 6, pp. 831-844.

Bakken, B.E. 2008, 'On Improving Dynamic Decision-Making: Implications From Multiple-Process Cognitive Theory', *Systems Research and Behavioral Science*, vol. 25, no. 4, pp. 493-501.

Baran, S.J. & Davis, D.K. 2006, *Mass Communication Theory: Foundations, Ferment, and Future*, 4th ed., Thomson Wadsworth, Belmont, California.

Barrett, A. 2005, 'The Information-Seeking Habits of Graduate Student Researchers in the Humanities', *The Journal of Academic Librarianship*, vol. 31, no. 4, pp. 324-331.

Barry, C.L. 1994, 'User-Defined Relevance Criteria: An Exploratory Study', *Journal of the American Society for Information Science*, vol. 45, no. 3, pp. 149-159.
Barry, C.L. & Schamber, L. 1998, 'Users' Criteria for Relevance Evaluation: A Cross-Situational Comparison', *Information Processing and Management*, vol. 34, no. 2/3, pp. 219-236.

Bauer, M.W., Gaskell, G. & Allum, N.C. 2000, 'Quality, Quantity and Knowledge Interests: Avoiding Confusions', in *Qualitative Researching With Text, Image and Sound: A Practical Handbook*, Bauer, M.W. & Gaskell, G. (Eds.), Sage Publications, London, pp. 3-17.

Baumeister, R.F., DeWall, C.N. & Zhang, L. 2007, 'Do Emotions Improve or Hinder the Decision Making Process?', in *Do Emotions Help or Hurt Decision Making?: A Hedgefoxian Perspective*, Vohs, K.D., Baumeister, R.F. & Loewenstein, G. (Eds.), Russell Sage Foundation, New York, pp. 11-31.

Berryman, J.M. 2008a, 'Judgements During Information Seeking: A Naturalistic Approach to Understanding the Assessment of Enough Information', *Journal of Information Science*, vol. 34, no. 2, pp. 196-206.

Berryman, J.M. 2008b, 'Judgements during Information Seeking: Policy and Research Workers' Assessments of Enough Information', PhD thesis, University of Technology, Sydney. Retrieved 26 September 2011 from http://utsescholarship.lib.uts.edu.au/dspace/bitstream/handle/2100/1076/02Whole.pdf ?sequence=2.

Betsch, T. 2005, 'Preference Theory: An Affect-Based Approach to Recurrent Decision Making', in *The Routines of Decision Making*, Betsch, T. & Haberstroh, S. (Eds.), Lawrence Erlbaum Associates, Mahwah, New Jersey, pp. 39-65.

Betsch, T. & Haberstroh, S. 2005, 'Current Research on Routine Decision Making: Advances and Prospects', in *The Routines of Decision Making*, Betsch, T. & Haberstroh, S. (Eds.), Lawrence Erlbaum Associates, Mahwah, New Jersey, pp. 359-376.

Borlund, P. 2003, 'The Concept of Relevance in IR', *Journal of the American Society for Information Science and Technology*, vol. 54, no. 10, pp. 913-925.

Bowler, L. 2010, 'The Self-Regulation of Curiosity and Interest During the Information Search Process of Adolescent Students', *Journal of the American Society for Information Science and Technology*, vol. 61, no. 7, pp. 1332-1344.

Boyle, D.G. 1969, *A Students' Guide to Piaget*, Pergamon Press, Oxford.

Brand-Gruwel, S. & Gerjets, P. 2008, 'Instructional Support for Enhancing Students' Information Problem Solving Ability', *Computers in Human Behavior*, vol. 24, no. 3, pp. 615-622.

Bråten, I., Strømsø, H.I. & Salmerón, L. 2011, 'Trust and Mistrust When Students Read Multiple Information Sources About Climate Change', *Learning and Instruction*, vol. 21, no. 2, pp. 180-192.

Breivik, P.S. 1998, *Student Learning in the Information Age*, Oryx Press, Phoenix, AZ.

Brooks, D.W. & and Shell, D.F. 2006, 'Working Memory, Motivation, and Teacher-Initiated Learning', *Journal of Science Education and Technology*, vol. 15, no. 1, pp. 17-30.

Brown, C., Murphy, T.J. & Nanny, M. 2003, 'Turning Techno-Savvy into Info-Savvy: Authentically Integrating Information Literacy into the College Curriculum', *Journal of Academic Librarianship*, vol. 29, no. 6, pp. 386-398.

Brown, R. & Pressley, M. 1994, 'Self-Regulated Reading and Getting Meaning from Text: The Transactional Strategies Instruction Model and Its Ongoing Validation', in *Self-Regulation of Learning and Performance: Issues and Educational Applications*, Schunk, D.H. & Zimmerman, B.J. (Eds.), Lawrence Erlbaum Associates, Hillsdale, NJ.

Buckland, M. 2012, 'What Kind of Science *Can* Information Science Be?', *Journal of the American Society for Information Science and Technology*, vol. 63, no. 1, pp. 1-7.

Budd, J.M. 2004, 'Relevance: Language, Semantics, Philosophy', *Library Trends*, vol. 52, no. 3, pp. 447-462.

Cader R., Campbell S. & Watson D. 2009, 'Judging Nursing Information on the WWW: A Theoretical Understanding', *Journal of Advanced Nursing*, vol. 65, no. 9, pp. 1916–1925.

Candy, P.C. 2004, *Linking Thinking: Self-Directed Learning in the Digital Age*, Department of Education, Science and Training, Australian Government, Canberra. Retrieved 12 April 2008 from http://www.dest.gov.au/NR/rdonlyres/5CBAC2EE-D568-4829-8332-0739057BBE1B/2205/report.pdf.

Carpenter, D.M., DeVellis, R.F., Hogan, S.L., Fisher, E.B., DeVellis, B.M. & Jordan, J.M. 2011, 'Use and Perceived Credibility of Medication Information Sources for Patients with a Rare Illness: Differences by Gender', *Journal of Health Communication*, vol. 16, no. 6, pp. 629-642.

Carruthers, P. 2009, 'How We Know Our Own Minds: The Relationship Between Mindreading and Metacognition', *Behavioral and Brain Sciences*, vol. 32, no. 2, pp. 121-138.

Case, D.O. 2006, 'Information Behavior', *Annual Review of Information Science and Technology*, vol. 40, no. 1, pp. 293-327.

Cerdán, R. & Vidal-Abarca, E. 2008, 'The Effects of Tasks on Integrating Information From Multiple Documents', *Journal of Educational Psychology*, vol. 100, no. 1, pp. 209 -222.

Charmaz, K. 2006, *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*, Sage Publications, London.

Choi, Y. & Rasmussen, E.M. 2002, 'Users' Relevance Criteria in Image Retrieval in American History', *Information Processing & Management*, vol. 38, no. 5, pp. 695-726.

Chu, H. 2011, 'Factors Affecting Relevance Judgment: A Report from TREC Legal Track', *Journal of Documentation*, vol. 67, no. 2, pp. 264-278.

Chung, J.S. & Neuman, D. 2007, 'High School Students' Information Seeking and Use for Class Projects', *Journal of the American Society for Information Science and Technology*, vol. 58, no. 10, pp. 1503-1517.

Cohen, L., Manion, L. & Morrison, K. 2000, *Research Methods in Education*, 5th ed., RoutledgeFarmer, London.

Coiro, J. & Dobler, E. 2007, 'Exploring the Online Reading Comprehension Strategies Used by Sixth-Grade Skilled Readers to Search for and Locate Information on the Internet', *Reading Research Quarterly*, vol. 42, no. 2, pp. 214-257.

Cole, C. 2011, 'A Theory of Information Need for Information Retrieval That Connects Information to Knowledge', *Journal of the American Society for Information Science and Technology*, vol. 62, no. 7, pp. 1216-1231.

Coppola, P., Della Mea, V., Di Gaspero, L. & Mizzaro, S. 2004, 'The Concept of Relevance in Mobile and Ubiquitous Information Access', in *Mobile and Ubiquitous Information Access*, Crestani, F., Dunlop, M. & Mizzaro, S. (Eds.), Springer-Verlag, Berlin, pp. 1-10.

Corrigan, G.J. 2001, 'Conceptual Development, Investigative Skills and Decisions About Processes', author-provided, pre-submission edition of unpublished PhD thesis, Faculty of Education, University of Sydney.

Cosijn, E. 2006. 'Relevance Judgements Within the Context of Work Tasks', in *Proceedings of the 1st International Conference on Information Interaction in Context* (IIiX; Copenhagen, Denmark, October 18-20), vol. 176, ACM, New York, pp. 20-29.

Cosijn, E. & Ingwersen, P. 2000, 'Dimensions of Relevance', *Information Processing & Management*, vol. 36, no. 4, pp. 533-550.

Courtright, C. 2007, 'Context in Information Behavior Research', *Annual Review of Information Science and Technology*, vol., 41, no. 1, pp. 273-306.

Creswell, J.W. 2007, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*, 2nd ed., Sage Publications, Thousand Oaks.

Crystal, A. & Greenberg, J. 2006, 'Relevance Criteria Identified by Health Information Users During Web Searches', *Journal of the American Society for Information Science and Technology*, vol. 57, no. 10, pp. 1368-1382.

Currie, L., Devlin, F., Emde, J. & Graves, K. 2010, 'Undergraduate Search Strategies and Evaluation Criteria: Searching for Credible Sources', *New Library World*, vol. 111, no. 3/4, pp.113-124.

Dawes, R.M. 1988, *Rational Choice in an Uncertain World*, Harcourt Brace College Publishers, Fort Worth.

Denzin, N.K. & Lincoln, Y.S. 2003, 'Introduction: The Discipline and Practice of Qualitative Research' in *Collecting and Interpreting Qualitative Materials*, 2nd ed., Denzin, N.K. & Lincoln, Y.S. (Eds.), Sage Publications, Thousand Oaks, California, pp. 1-45.

Desai, M. & Spink, A. 2005, 'An Algorithm to Cluster Documents Based on Relevance', *Information Processing & Management*, vol. 41, no. 5, pp. 1035-1049.

Dey, I. 1999, *Grounding Grounded Theory: Guidelines for Qualitative Inquiry*, Academic Press, San Diego.

Dieterle, U., Richmond, B., Markgraf, J., Kasuboski, A., Piele, L., Cardinal, D., Olson, C. & Zillner, S. 2000 (updated March 2000), *Evaluating Information*, University of Wisconsin - Eau Claire, Eau Claire, WI. Retrieved 12 March 2008 from http://www.uwec.edu/Library/tutorial/mod5/.

Doherty, M.E. 2003, 'Optimists, Pessimists, and Realists', in *Emerging Perspectives on Judgment and Decision Research*, Schneider, S.L. & Shanteau, J. (Eds.), Cambridge University Press, Cambridge, pp. 643-679.

Dresang, E.T. 2005, 'The Information-Seeking Behavior of Youth in the Digital Environment', *Library Trends*, vol. 54, no. 2, pp. 178-196.

Eastin, M.S., Yang, M.-S. & Nathanson, A.I. 2006, 'Children of the Net: An Empirical Exploration Into the Evaluation of Internet Content', *Journal of Broadcasting & Electronic Media*, vol. 50, no. 2, pp. 211-230.

Ellis, C. & Bochner, A.P. 2003, 'Autoethnography, Personal Narrative, Reflexivity: Researcher as Subject', in *Collecting and Interpreting Qualitative Materials*, 2nd ed., Denzin, N.K. & Lincoln, Y.S. (Eds.), Sage Publications, Thousand Oaks, California, pp. 199-258.

Ellis, D. & Haugan, M. 1997, 'Modelling the Information Seeking Patterns of Engineers and Research Scientists in an Industrial Environment', *Journal of Documentation*, vol. 53, no. 4, pp. 384-403.

Ericsson, K.A. 2002, 'Towards a Procedure for Eliciting Verbal Expression of Nonverbal Experience Without Reactivity: Interpreting the Verbal Overshadowing Effect Within the Theoretical Framework for Protocol Analysis', *Applied Cognitive Psychology*, vol. 16, pp. 981-987.

Ericsson, K.A. & Simon, H.A. 1993, *Protocol Analysis: Verbal Reports as Data*, MIT Press, Cambridge, Massachusetts.

Ericsson, K.A. & Simon, H.A. 1998, 'How to Study Thinking in Everyday Life: Contrasting Think-Aloud Protocols With Descriptions and Explanations of Thinking', *Mind, Culture, & Activity*, vol. 5, no. 3, pp. 178-186.

Eskola, E.-L. 2005, 'Information Literacy of Medical Students Studying in the Problem-Based and Traditional Curriculum', *Information Research*, vol. 10, no. 2. Retrieved 17 September 2011 from http://informationr.net/ir/10-2/paper221.html.

Etherington, K. 2004, *Becoming a Reflexive Researcher: Using Our Selves in Research*, Jessica Kingsley Publishers, London.

Fallis, D. 2006, 'Social Epistemology and Information Science', *Annual Review of Information Science and Technology*, vol. 40, no. 1, pp. 475-519.

Ferguson, J.E., Neely, T.Y. & Sullivan, K. 2006, 'A Baseline Information Literacy Assessment of Biology Students', *Reference & User Services Quarterly*, vol. 46, no. 2, pp. 61-71.

Fidel, R., Davies, R., Douglass, M., Holder, J., Hopkins, C., Kushner, E., Miyagishima, B. & Toney, C. 1999, 'A Visit to the Information Mall: Web Searching Behavior of High School Students', *Journal of the American Society for Information Science*, vol. 50, no. 1, pp. 24-37.

Fisher, K.E. & Julien, H. 2009, 'Information Behavior', *Annual Review of Information Science and Technology*, vol. 43, no. 1, pp. 1-73.

Fitzgerald, M.A. 2005, 'Skills for Evaluating Web-Based Information', Paper presented at the Internet Credibility and the User Symposium, Seattle, WA, 2005, pp. 1-19. Retrieved 27 July 2011 from http://projects.ischool.washington.edu/credibility/Fitzgerald Skills.pdf.

Fitzgerald, M.A. & Galloway, C. 2001, 'Relevance Judging, Evaluation, and Decision Making in Virtual Libraries: A Descriptive Study', *Journal of the American Society for Information Science and Technology*, vol. 52, no.12, pp. 989-1010.

Flanagin, A.J. & Metzger, M.J. 2007, 'The Role of Site Features, User Attributes, and Information Verification Behaviors on the Perceived Credibility of Web-Based Information', *New Media Society*, vol. 9, no. 2, pp. 319-342.

Flick, U. 2006, *An Introduction to Qualitative Research*, 3rd ed., Sage Publications, London.

Fogg, B.J. 2003, 'Prominence-Interpretation Theory: Explaining How People Assess Credibility Online', in *CHI '03 Extended Abstracts on Human Factors in Computing Systems*, pp. 722-723. Retrieved 28 April 2011 from http://credibility.stanford.edu/pdf/PITheory.pdf.

Fogg, B. J., Marshall, J., Laraki, O., Osipovich, A., Varma, C., Fang, N., Paul, J., Rangnekar, A., Shon, J., Swani, P. & Treinen, M. 2001, 'What Makes Web Sites Credible? A Report on a Large Quantitative Study', in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '01, 31 March - 5 April), vol. 3, no. 1, ACM, New York, pp. 61-68.

Fogg, B.J., Soohoo, C., Danielson, D.R., Marable, L., Stanford, J. & Tauber, E.R. 2003, 'How Do Users Evaluate the Credibility of Web Sites?: A Study with Over 2,500 Participants', in *Proceedings of the 2003 Conference on Designing for User Experiences* (DUX '03; San Francisco), ACM, New York.

Fontana, A. & Frey, J.H. 2003, 'The Interview: From Structured Questions to Negotiated Text', in *Collecting and Interpreting Qualitative Materials*, 2nd ed., Denzin, N.K. & Lincoln, Y.S. (Eds.), Sage Publications, Thousand Oaks, California, pp. 61-106.

Ford, N. 2004, 'Towards a Model of Learning for Educational Informatics', *Journal of Documentation*, vol. 60, no. 2, pp. 183-225.

Ford, N. 2008, 'Educational Informatics', *Annual Review of Information Science and Technology*, vol. 42, no. 1, pp. 497-544.

Francke, H. & Sundin, O. 2009, 'Format Agnostics or Format Believers? How Students in High School Use Genre to Assess Credibility', *Proceedings of the American Society for Information Science and Technology*, vol. 46, no. 1, 7 pages (unpaginated).

Francke, H., Sundin, O. & Limberg, L. 2011, 'Debating Credibility: The Shaping of Information Literacies in Upper Secondary School', *Journal of Documentation*, vol. 67, no. 4, pp. 675-694.

Frické, M. 2009, 'The Knowledge Pyramid: A Critique of the DIKW Pyramid', *Journal of Information Science*, vol. 35, no. 2, pp. 131-142.

Friestad, M. & Wright, P. 1994, 'The Persuasion Knowledge Model: How People Cope With Persuasion Attempts', *Journal of Consumer Research,* vol. 21, no. 1, pp. 1-31.

Fu, W.-T. & Gray, W.D. 2006, 'Suboptimal Tradeoffs in Information Seeking', *Cognitive Psychology*, vol. 52, no. 3, pp. 195-242.

Gaskell, G. 2000, 'Individual and Group Interviewing', in *Qualitative Researching With Text, Image and Sound: A Practical Handbook*, Bauer, M.W. & Gaskell, G. (Eds.), Sage Publications, London, pp. 38-56.

Gasper, K. & Isbell, L.M. 2007, 'Feeling, Searching, and Preparing: How Affective States Alter Information Seeking', in *Do Emotions Help or Hurt Decision Making?: A Hedgefoxian Perspective*, Vohs, K.D., Baumeister, R.F. & Loewenstein, G. (Eds.), Russell Sage Foundation, New York, pp. 93-116.

Gasser, U., Cortesi, S., Malik, M., & Lee, A. 2012, *Youth and Digital Media: From Credibility to Information Quality*, Berkman Center for Internet & Society. Retrieved 8 March 2012 from http://ssrn.com/abstract=2005272.

Gernsbacher, M.A. 1990, *Language comprehension as structure building*, Erlbaum, Hillsdale, NJ.

Gigerenzer, G. 2004, 'Fast and Frugal Heuristics: The Tools of Bounded Rationality', in *Blackwell Handbook of Judgment and Decision Making*, Koehler, D.J. & Harvey, N. (Eds.), Blackwell, Oxford, pp. 62-88.

Gigerenzer, G. & Brighton, H. 2009, 'Homo Heuristicus: Why Biased Minds Make Better Inferences', *Topics in Cognitive Science*, vol. 1, no. 1, pp. 107-143.

Gil, Y. & Artz, D. 2006, 'Towards Content Trust of Web Resources', in *Proceedings of the 15th International Conference on World Wide Web, WWW 2006*, (Edinburgh, Scotland, May 23-26). Retrieved 31 May 2011 from http://www2006.org/programme/files/pdf/4040.pdf.

Gladwell, M. 2006, *Blink: The Power of Thinking Without Thinking*, Penguin, London.

Goldstein, D.G. & Gigerenzer, G. 2002, 'Models of Ecological Rationality: The Recognition Heuristic', *Psychological Review*, vol. 109, no. 1, pp. 75-90.

Gordon, C. A. 2000, 'The Effects of Concept Mapping on the Searching Behavior of Tenth-Grade Students', *School Library Media Research*, vol. 2, article 6. Retrieved 19 October 2008 from http://www.ala.org/ala/aasl/aaslpubsandjournals/slmrb/slmrcontents/volume32000/mapping.htm.

Gordon, C.A. 2009, 'Raising Active Voices in School Libraries: Authentic Learning, Information Processing and *Guided Inquiry*', *Scan*, vol. 28, no. 3, pp. 34-41.

Green, R. & Macauley, P. 2007, 'Doctoral Students' Engagement With Information: An American-Australian Perspective', *Portal: Libraries and the Academy*, vol. 7, no. 3, pp. 317–332.

Gross, M. 2004, 'Children's Information Seeking at School: Findings from a Qualitative Study', in *Youth Information-Seeking Behavior: Theories, Models, and Issues*, Chelton, M.K & Cool, C. (Eds.), Scarecrow Press, Lanham, Maryland, pp. 211-240.

Haines, B.A. & Moore, C. 2003, 'Integrating Themes from Cognitive and Social Cognitive Development into the Study of Judgment and Decision Making', in *Emerging Perspectives on Judgment and Decision Research*, Schneider, S.L. & Shanteau, J. (Eds.), Cambridge University Press, Cambridge, pp. 246-283.

Hall, W.A. & Callery, P. 2001, 'Enhancing the Rigor of Grounded Theory: Incorporating Reflexivity and Relationality', *Qualitative Health Research*, vol. 11, no. 2, pp. 257-272.

Hargittai, E., Fullerton, L., Menchen-Trevino, E. & Thomas, K.Y. 2010, 'Trust Online: Young Adults' Evaluation of Web Content', *International Journal of Communication*, vol. 4, pp. 468-494.

Harry, B., Sturges, K.M. & Klingner, J.K. 2005, 'Mapping the Process: An Exemplar of Process and Challenge in Grounded Theory Analysis', *Researcher*, vol. 34, no. 2, pp. 3-13.

Heinström, J. 2002, 'Fast Surfers, Broad Scanners and Deep Divers: Personality and Information-Seeking Behaviour', doctoral thesis, Åbo Akademi University Press, Turku. Retrieved 14 November 2008 from www.abo.fi/~jheinstr/thesis.htm.

Heinström, J. 2006, 'Fast Surfing for Availability or Deep Diving into Quality – Motivation and Information Seeking Among Middle and High School Students', *Information Research*, vol. 11 no. 4. Retrieved 22 November 2008 from http://informationr.net/ir/11-4/paper265.html.

Herring, J.A. 2006, 'Critical Investigation of Students' and Teachers' Views of the Use of Information Literacy Skills in School Assignments', *School Library Media Research*, vol. 9, pp. [1-13]. Retrieved 28 September 2007 from http://www.ala.org/ala/aasl/aaslpubsandjournals/slmrb/slmrcontents/volume9/informationliteracy.cfm.

Hertzum, M., Andersen, H.H.K., Andersen, V. & Hansen, C.B. 2002, 'Trust in Information Sources: Seeking Information from People, Documents, and Virtual Agents', *Interacting with Computers*, vol. 14, no. 5, pp. 575-599.

Higgins, M. 1999, 'Meta-Information, and Time: Factors in Human Decision Making', *Journal of the American Society for Information Science*, vol. 50, no. 2, pp. 132-139.

Hilligoss, B. & Rieh, S.Y. 2008, 'Developing a Unifying Framework of Credibility Assessment: Construct, Heuristics, and Interaction in Context', *Information Processing and Management*, vol. 44, no. 4, pp. 1467-1484.

Hirsh, S.G. 1999, 'Children's Relevance Criteria and Information Seeking on Electronic Resources', *Journal of the American Society for Information Science*, vol. 50, no. 14, pp. 1265-1283.

Hjørland, B. 2000a, 'Relevance Research: The Missing Perspective(s): Non-Relevance and Epistemological Relevance', letter to the editor, *Journal of the American Society for Information Science*, vol. 51, no. 2, pp. 209-211.

Hjørland, B. 2000b, 'Documents, Memory Institutions, and Information Science', *Journal of Documentation*, vol. 56, no. 1, pp. 27-41.

Hofer, B.K. 2004, 'Epistemological Understanding as a Metacognitive Process: Thinking Aloud During Online Searching', *Educational Psychologist*, vol. 39, no. 1, pp. 43-55.

Hogarth, R.M. 2005, 'Deciding Analytically or Trusting Your Intuition?: The Advantages and Disadvantages of Analytic and Intuitive Thought', in *The Routines of Decision Making*, Betsch, T. & Haberstroh, S. (Eds.), Lawrence Erlbaum Associates, Mahwah, New Jersey, pp. 67-82.

Hogarth, R.M. & Karelaia, N. 2006, 'Regions of Rationality: Maps for Bounded Agents', *Decision Analysis*, vol. 3, no. 3, pp. 124-144.

Holliday, W. & Li, Q. 2004, 'Understanding the Millennials: Updating Our Knowledge About Students', *Reference Services Review*, vol. 32, no. 4, pp. 356-366.

Hong, W., Thong, J., Wong, W. & Tam, K. 2001, 'Determinants of User Acceptance of Digital Libraries: An Empirical Examination of Individual Differences and Systems Characteristics', *Journal of Management Information Systems*, vol. 18, no. 3, pp. 97-124.

Howard, R.A. 2007, 'The Foundations of Decision Analysis Revisited', in *Advances in Decision Analysis: From Foundations to Applications*, Edwards, W., Miles, R.F., & von Winterfeldt, D. (Eds.), Cambridge University Press, Cambridge, pp. 32-56.

Hughes, B., Wareham, J. & Joshi, I. 2010, 'Doctors' Online Information Needs, Cognitive Search Strategies, and Judgments of Information Quality and Cognitive Authority: How Predictive Judgments Introduce Bias Into Cognitive Search Models', *Journal of the American Society for Information Science and Technology*, no. 61, no. 3, pp. 433-452.

Iding, M.K., Crosby, M.E., Auernheimer, B. & Klemm, E.B. 2009, 'Web Site Credibility: Why Do People Believe What They Believe?', *Instructional Science*, vol. 37, no. 1, pp. 43-63.

Ingwersen, P. & Järvelin, K. 2005, *The Turn: Integration of Information Seeking and Retrieval in Context*, Springer, Dordrecht.

Jacsó, P. 2006, 'Savvy Searching: Pertinence in the Eye of the User', *Online Information Review*, vol. 30, no. 1, pp. 70-76.

Jansen, B.J. & Spink, A. 2006, 'How Are We Searching the World Wide Web?: A Comparison of Nine Search Engine Transaction Logs', *Information Processing and Management*, vol. 42, no. 1, pp. 248-263.

Jenson, J.D. 2003, 'It's the Information Age, So Where's the Information?', *College Teaching*, vol. 52, no. 3, pp. 107-112.

Jo, S. 2005, 'The Effect of Online Media Credibility on Trust Relationships', *Journal of Website Promotion*, vol. 1, no. 2, pp. 57-78.

Joachims, T., Granka, L., Pan, B., Hembrooke, H., Radlinski, F. & Gay, G. 2007, 'Evaluating the Accuracy of Implicit Feedback from Clicks and Query Reformulations in Web Search', *ACM Transactions on Information Systems*, vol. 25, no. 2, pp. 1-27.

Johnson, J.G. & Busemeyer, J.R. 2005, 'Rule-Based Decision Field Theory: A Dynamic Computational Model of Transitions Among Decision-Making Strategies', in *The Routines of Decision Making*, Betsch, T. & Haberstroh, S. (Eds.), Lawrence Erlbaum Associates, Mahwah, New Jersey, pp. 3-20.

Jones, M.H., Estell, D.B. & Alexander, J.M. 2008, 'Friends, Classmates, and Self-Regulated Learning: Discussions With Peers Inside and Outside the Classroom', *Metacognition and Learning*, vol. 3, no. 1, pp. 1-15.

Joseph, N. 2006, 'Strategies for Success: Teaching Metacognitive Skills to Adolescent Learners', *New England Reading Association Journal*, vol. 42, no. 1, pp. 33-39; 75.

Jovchelovitch, S. & Bauer, M.W. 2000, 'Narrative Interviewing', in *Qualitative Researching With Text, Image and Sound: A Practical Handbook*, Bauer, M.W. & Gaskell, G. (Eds.), Sage Publications, London, pp. 57-74.

Kahneman, D. & Frederick, S. 2005, 'A Model of Heuristic Judgment', in *The Cambridge Handbook of Thinking and Reasoning*, Holyoak, K.J. & Morrison, R.G. (Eds.), Cambridge University Press, Cambridge, pp. 267-293.

Kari, J. & Savolainen, R. 2007, 'Relationships Between Information Seeking and Context: A Qualitative Study of Internet Searching and the Goals of Personal Development', *Library & Information Science Research*, vol. 29, no. 1, pp. 47-69.

Keller, N., Cokely, E.T., Katsikopoulos, K.V. & Wegwarth, O. 2010, 'Naturalistic Heuristics for Decision Making', *Journal of Cognitive Engineering and Decision Making*, vol. 4, no. 3, pp. 256-274.

Kelly, D. 2005, 'Implicit Feedback: Using Behavior to Infer Relevance', in *New Directions in Cognitive Information Retrieval*, Spink, A. & Cole, C. (Eds.), Springer, Amsterdam, pp. 169-186.

Kelly, D. 2006, 'Measuring Online Information Seeking Context, Part 1: Background and Method' *Journal of the American Society for Information Science and Technology*, vol. 57, no. 13, pp. 1729-1739.

Kelton, K., Fleischmann, K.R. & Wallace, W.A. 2008, 'Trust in Digital Information', *Journal of the American Society for Information Science and Technology*, vol. 59, no. 3, pp. 363-374.

Kim, S. 2010, 'Questioners' Credibility Judgments of Answers in a Social Question and Answer Site', *Information Research,* vol. 15, no. 2. Retrieved 21 August 2011 from http://InformationR.net/ir/15- 2/paper432.html.

Kim, S. & Oh, S. 2009, 'Users' Relevance Criteria for Evaluating Answers in a Social Q&A Site', *Journal of the American Society for Information Science and Technology*, vol. 60, no. 4, pp. 716-727.

Kitchener, K. S. 1983, 'Cognition, Metacognition, and Epistemic Cognition', *Human Development,* vol. 26, no. 4, pp. 222-232.

Krippendorff, K. 2004, *Content Analysis: An Introduction to its Methodology*, 2nd ed., Sage Publications, London.

Kuhlthau, C.C. 1988, 'Longitudinal Case Studies of the Information Search Process of Users in Libraries', *Library and Information Science Research,* vol. 10, pp. 257-304.

Kuhlthau, C.C. 1989, 'Information Search Process: A Summary of Research and Implications for School Library Media Programs', *School Library Media Quarterly*, vol. 18, no. 1. Retrieved 18 April 2008 from http://www.ala.org/ala/aasl/aaslpubsandjournals/slmrb/editorschoiceb/infopower/selectkuhlthau2.cfm.

Kuhlthau, C.C. 1991, 'Inside the Search Process: Information Seeking From the User's Perspective', *Journal of the American Society for Information Science,* vol. 42, no. 5, pp. 361-371.

Kuhlthau, C.C. 2004, *Seeking Meaning: A Process Approach to Library and Information Services*, 2nd ed., Libraries Unlimited, Westport, Connecticut.

Kuhlthau, C.C. 2007, 'Reflections on the Development of the Model of the Information Search Process (ISP): Excerpts from the Lazerow Lecture, University of Kentucky, April 2, 2007', *Bulletin of the American Society for Information Science and Technology*, vol. 33, no. 5, pp. 32-37. Retrieved 26 February 2008 from http://www.asis.org/Bulletin/Jun-07/Kuhlthau.pdf.

Kuhlthau, C.C., Maniotes, L.K. & Caspari, A.K. 2007, *Guided Inquiry: Learning in the 21st Century*, Libraries Unlimited, Westport, CT.

Kuhlthau, C.C. & Todd, R. 2007 (updated April 2007), 'SLIM toolkit', *Guided Inquiry*, Center for International Scholarship in School Libraries at Rutgers University. Retrieved 11 August 2007 from http://cissl.scils.rutgers.edu/guided_inquiry/slim.html.

Ladbrook, J. 2010, 'Research Note: Our Emerging Net Generation: Are They Information Literate?', *New Zealand Journal of Educational Studies*, vol. 45, no.1, pp. 67-75.

Ladbrook, J. & Probert, E. 2011, 'Information skills and critical literacy: Where are our digikids at with online searching and are their teachers helping?', *Australasian Journal of Educational Technology*, vol. 27, no. 1, pp. 105-121.

Large, A. & Beheshti, J. 2002, 'The Web as a Classroom Resource: Reactions from the Users', *Journal of the American Society for Information Science*, vol. 51, no. 12, pp. 1069-1080.

Lattuca, L.R. 2006, 'The Constructivist Pedagogy We're Looking For', *Journalism & Mass Communication Educator*, vol. 60, no. 4; pp. 354-358.

LeBoeuf, R.A. & Shafir, E.B. 2005, 'Decision Making', in *The Cambridge Handbook of Thinking and Reasoning*, Holyoak, K.J. & Morrison, R.G. (Eds.), Cambridge University Press, Cambridge, pp. 243-265.

Leedy, P.D. & Ormrod, J.E. 2005, *Practical Research: Planning and Design*, 8th ed., Pearson, Upper Saddle River, New Jersey.

Leonardi, P.M. & Barley, S.R. 2008, 'Materiality and Change: Challenges to Building Better Theory About Technology and Organizing', *Information and Organization*, vol. 18, no. 3, pp. 159-176.

Leslie, J. C. & O'Reilly, M.F. 1999, *Behavior Analysis: Foundations and Applications to Psychology*, Harwood Academic Publishers, Amsterdam.

Lim, S. 2009, 'How and Why do College Students Use Wikipedia?', *Journal of the American Society for Information Science and Technology*, vol. 60, no. 11, pp. 2189-2202.

Limberg, L. 2007, 'Learning Assignment as Task in Information Seeking Research', *Information Research*, vol. 12, no. 4. Retrieved 11 June 2011 from http://informationr.net/ir/12-4/colis/colis28.html.

Liu, Z. 2004, 'Perceptions of Credibility of Scholarly Information on the Web', *Information Processing and Management*, vol. 40, no. 6, pp. 1027-1038.

Lloyd, A. 2007, 'Recasting Information Literacy as Sociocultural Practice: Implications for Library and Information Science Researchers', *Information Research*, vol. 12, no. 4. Retrieved 14 February 2011 from http://informationr.net/ir/12-4/colis/colis34.html.

Loewenstein, G.F., Weber, E.U., Hsee, C.K. & Welch, N. 2001, 'Risk as feelings', *Psychological Bulletin*, vol. 127, no. 2, pp. 267-286.

Lynch, D.J. 2006, 'Motivational Factors, Learning Strategies and Resource Management as Predictors of Course Grades', *College Student Journal*, vol. 40, no. 2, pp. 423-428.

Maglaughlin, K.L. & Sonnenwald, D.H. 2002, 'User Perspectives on Relevance Criteria: A Comparison Among Relevant, Partially Relevant, and Not-Relevant Judgements', *Journal of the American Society for Information Science and Technology*, vol. 53, no. 5, pp. 327-342.

Mannes, S. & St George, M. 1996, 'Effects of Prior Knowledge on Text Comprehension: A Simple Modeling Approach', in *Models of Understanding Text*, Britton, B.K. & Graesser, A.C. (Eds.), Lawrence Erlbaum Associates, Mahwah, NJ, pp.115-140.

Mason, L., Boldrin, A. & Ariasi, N. 2010, 'Epistemic Metacognition in Context: Evaluating and Learning Online Information', *Metacognition Learning*, vol. 5, no. 1, pp. 67–90.

McGregor, J. 1995, 'Process or Product: Constructing or Reproducing Knowledge', *School Libraries Worldwide*, vol. 1, no. 1, pp. 28-40.

McGuinness, C. & Brien, M. 2007, 'Using Reflective Journals to Assess the Research Process', *Reference Services Review*, vol. 35, no. 1, pp. 21-40.

Meola, M. 2004, 'Chucking the Checklist: A Contextual Approach to Teaching Undergraduates Web-Site Evaluation', *Portal: Libraries and the Academy*, vol. 4, no. 3, pp. 331-344.

Metzger, M.J. 2007, 'Making Sense of Credibility on the Web: Models for Evaluating Online Information and Recommendations for Future Research', *Journal of the American Society for Information Science and Technology*, vol. 58, no. 13, pp. 2078-2091.

Metzger, M.J., Flanagin, A.J. & Medders, R.B. 2010, 'Social and Heuristic Approaches to Credibility Evaluation Online', *Journal of Communication*, vol. 60, no. 3, pp. 413-439.

Miller, S.C. n.d., 'Education and Heuristics: A Model of Market Learning'. Retrieved 28 August 2011 from http://www.gmu.edu/rae/archives/Miller_essay.pdf.

Miller. S.C. 2010, 'Price: The Ultimate Heuristic', in *Handbook on Contemporary Austrian Economics*, Boettke, P. (Ed.), Edward Elgar, Cheltenham, UK, pp. 67-76.

Minichiello, V., Aroni, R., Timewell, E. & Alexander, L. 1995, *In-Depth Interviewing: Principles, Techniques, Analysis*, 2nd ed., Longman, Melbourne.

Misailidi, P. 2010, 'Children's Metacognition and Theory of Mind: Bridging the Gap', in *Trends and Prospects in Metacognition Research*, Efklides, A. & Misailidi, P. (Eds.), Springer, New York, pp. 279-291.

Moon, J.A. 2006, *Learning Journals: A Handbook for Reflective Practice and Professional Development*, 2nd ed., Routledge, London.

Moos, D.C. & Azevedo, R. 2008, 'Self-Regulated Learning with Hypermedia: The Role of Prior Domain Knowledge', *Contemporary Educational Psychology*, vol. 33, no. 2, pp. 270-298.

Mruck, K. & Mey, G. 2007, 'Grounded Theory and Reflexivity', in *The Sage Handbook of Grounded Theory*, Bryant, A. & Charmaz, K. (Eds.), pp. 515-538.

Muis, K.R. 2008, 'Epistemic Profiles and Self-Regulated Learning: Examining Relations in the Context of Mathematics Problem Solving', *Contemporary Educational Psychology*, vol. 33, no. 2, pp. 177-208.

Muller, D.A., Sharma, M.D. & Reimann, P. 2008, 'Raising Cognitive Load With Linear Multimedia to Promote Conceptual Change', *Science Education*, vol. 92, no. 2, pp. 278-296.

New Oxford American Dictionary [application software], n.d., Version 2.1.3.

New South Wales …, *see* NSW … .

Newell, B.R., Lagnado, D.A. & Shanks, D.R. 2007, *Straight Choices: The Psychology of Decision Making*, Psychology Press, Hove.

Nicholas, N., Huntington, P., Jamali, H.R., Rowlands, I., Fieldhouse, M. 2009, 'Student Digital Information-Seeking Behaviour in Context', *Journal of Documentation*, vol. 65, no. 1, pp. 106-132.

Nokes, J.D., Dole, J.A. & Hacker, D.J. 2007, 'Teaching High School Students to Use Heuristics While Reading Historical Texts', *Journal of Educational Psychology*, vol. 99, no. 3, pp. 492-504.

Nov, O. & Ye, C. 2008, 'Users' Personality and Perceived Ease of Use of Digital Libraries: The Case for Resistance to Change', *Journal of the American Society for Information Science and Technology*, vol. 59, no. 5, pp. 845-851.

Nowicki, S. 2003, 'Student vs. Search Engine: Undergraduates Rank Results for Relevance', *Portal: Libraries and the Academy,* vol. 3, no. 3, pp. 503-515.

NSW [New South Wales] Department of Education [?1989], 'The Information Process', *Information Skills in the School,* Sydney, NSW Department of Education, pp. 6-8.

O'Brien, M. and Keane, M.T. 2006, 'Modeling Result-List Searching in the World Wide Web: The Role of Relevance Topologies and Trust Bias,' *Proceedings of the 28th Annual Conference of the Cognitive Science Society,* pp. 1881-1886.

Oliver, R. & Oliver, H. 1997, 'Using Context to Promote Learning from Information-Seeking Tasks', *Journal of the American Society for Information Science*, vol. 48. no. 6, pp. 519-526.

Omodei, M.M., McLennan, J. & Wearing, A.J. 2005, 'How Expertise is Applied in Real-World Dynamic Environments: Head-Mounted Video and Cued Recall as a Methodology for Studying Routines of Decision Making', in *The Routines of Decision-Making,* Betsch, T. & Haberstroh, S. (Eds.), Lawrence Erlbaum Associates, New York, pp. 271-288.

Omodei, M.M., Wearing, A.J. & McLennan, J. 1998, 'Head-Mounted Video Recording: A Methodology for Studying Naturalistic Decision Making', in *Decision Making Under Stress: Emerging Themes and Applications*, Flin, R., Salas, E., Strub, M. & Martin, L. (Eds.), Ashgate, Aldershot, pp. 137-146.

Otterbacher, J. & Radev, D. 2008, 'Exploring Fact-Focused Relevance and Novelty Detection', *Journal of Documentation,* vol. 64, no. 4, pp. 496-510.

Pan, B., Hembrooke, H., Joachims, T., Lorigo, L., Gay, G., and Granka, L. 2007, In Google We Trust: Users' Decisions on Rank, Position, and Relevance, *Journal of Computer-Mediated Communication,* vol. 12, no. 3. Retrieved 21 July 2011 from http://jcmc.indiana.edu/vol12/issue3/pan.html.

Papert, S. 1991, 'Situating Constructionism', in *Constructionism,* Harel, I. & Papert, S (Eds.), Ablex Publishing, Norwood, NJ, pp. 1-12. Retrieved 21 August 2011 from http://namodemello.com.br/pdf/tendencias/situatingconstrutivism.pdf.

Parker, N. [N.J.] 2001, 'Student Learning as Information Behaviour: Exploring Assessment Task Processes', *Information Research*, vol. 6, no. 2. Retrieved 10 June 2011 from http://InformationR.net/ir/6-2/ws5.html.

Parker, N.J. 2006, 'Assignments, Information and Learning: The Postgraduate Experience', PhD thesis, University of Technology, Sydney. Retrieved 11 June 2011 from http://epress.lib.uts.edu.au/dspace/bitstream/handle/2100/1060/02whole.pdf?sequence=2.

Paulsen, M.B. & Feldman, K.A. 2005, The Conditional and Interaction Effects of Epistemological Beliefs on the Self-Regulated Learning of College Students: Motivational Strategies', *Research in Higher Education*, vol. 46, no. 7, pp. 731-768.

Paulsen, M.B. & Feldman, K.A. 2007, The Conditional and Interaction Effects of Epistemological Beliefs on the Self-Regulated Learning of College Students: Cognitive and Behavioral Strategies', *Research in Higher Education*, vol. 48, no. 3, pp. 353-401.

Peper, R.J. & Mayer, R. E. 1986, 'Generative Effects of Note-Taking during Science Lectures', *Journal of Educational Psychology*, vol. 78, no. 1, pp. 34-38.

Peräkylä, A. 1997, 'Reliability and Validity in Research Based on Tapes and Transcripts' in *Qualitative Research: Theory, Method and Practice*, Silverman, D. (Ed.), Sage, London, pp. 201-220.

Petty, R. E. & Cacioppo, J. T. 1986, 'The Elaboration Likelihood Model of Persuasion', *Advances in Experimental Social Psychology*, vol. 19, pp. 123-205. Retrieved 9 October 2011 from http://psychology.uchicago.edu/people/faculty/cacioppo/jtcreprints/pc86.part1.pdf, http://psychology.uchicago.edu/people/faculty/cacioppo/jtcreprints/pc86.part2.pdf, and http://psychology.uchicago.edu/people/faculty/cacioppo/jtcreprints/pc86.part3.pdf.

Pirolli, P. 2005, 'Rational Analyses of Information Foraging on the Web', *Cognitive Science*, vol. 29, no. 3, pp. 343-373.

Pirolli, P. & Card, S. 1999, 'Information Foraging', *Psychological Review*, vol. 106, no. 4, pp. 643-675.

Pliske, R. & Klein, G. 2003, 'The Naturalistic Decision-Making Perspective', in *Emerging Perspectives on Judgment and Decision Research*, Schneider, S.L. & Shanteau, J. (Eds.), Cambridge University Press, Cambridge, pp. 559-585.

Prabha, C., Connaway, L.S., Olszewski, L. & Jenkins, L.R. 2007, 'What is Enough?: Satisficing Information Needs', *Journal of Documentation*, vol. 63, no. 1, pp. 74-89.

Punch, K.F. 2005, *Introduction to Social Research: Quantitative and Qualitative Approaches*, 2nd ed., Sage, London.

QSR International Pty Ltd. 2008 and 2010, *NVivo qualitative data analysis software* [computer program], Versions 8 and 9.

Reason, P. 1998, 'Three Approaches to Participative Inquiry', in *Strategies of Qualitative Inquiry*, Denzin, N.K. & Lincoln, Y.S. (Eds.), Sage Publications, London, pp. 261-291.

Rieger, O.Y. 2009, 'Search Engine Use Behavior of Students and Faculty: User Perceptions and Implications for Future Research', *First Monday*, vol. 14, no. 12. Retrieved 27 August 2011 from http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2716/2385.

Rieh, S.Y. 2002, 'Judgment of Information Quality and Cognitive Authority in the Web', *Journal of the American Society for Information Science and Technology*, vol. 53, no. 2, pp. 145-161.

Rieh, S.Y. & Danielson, D.R. 2007, 'Credibility: A Multidisciplinary Framework', *Annual Review of Information Science and Technology*, vol. 41, no. 1, pp. 307-364.

Robins, D. & Holmes, J. 2008, 'Aesthetics and Credibility in Web Site Design', *Information Processing and Management*, vol. 44, no. 1, pp. 386-399.

Robins, D., Holmes, J. & Stansbury, M. 2010, 'Consumer Health Information on the Web: The Relationship of Visual Design and Perceptions of Credibility', *Journal of the American Society for Information Science and Technology*, vol. 61, no. 1, pp. 13-29.

Robinson, L. 2000, ‘A Strategic Approach to Research Using Internet Tools and Resources’, *Aslib Proceedings*, vol. 52, no. 1, pp. 11-19.

Ross, K.G., Lussier, J.W. & Klein, G. 2005, ‘From the Recognition Primed Decision Model to Training’, in *The Routines of Decision Making*, Betsch, T. & Haberstroh, S. (Eds.), Lawrence Erlbaum Associates, Mahwah, New Jersey, pp. 327-341.

Ruthven, I. 2005, ‘Integrating Approaches to Relevance’, in *New Directions in Cognitive Information Retrieval*, Spink, A. & Cole, C. (Eds.), Springer, Amsterdam, pp. 61-80.

Ruthven, I., Baillie, M., Elsweiler, D. 2007, ‘The Relative Effects of Knowledge, Interest and Confidence in Assessing Relevance’, *Journal of Documentation*, vol. 63, no. 4, pp. 482-504.

Sadler, D. R. 2002, ‘Intuitive Data Processing as a Potential Source of Bias in Naturalistic Evaluations’, in *The Qualitative Researcher’s Companion*, Huberman, A.M. & Miles, M.B. (Eds.). Sage Publications, Thousand Oaks, California, pp. 123-135.

Saracevic, T. 2007a, ‘Relevance: A Review of the Literature and a Framework for Thinking on the Notion in Information Science. Part II: Nature and Manifestations of Relevance’, *Journal of the American Society for Information Science and Technology*, vol. 58, no. 13, pp. 1915-1933.

Saracevic, T. 2007b, ‘Relevance: A Review of the Literature and a Framework for Thinking on the Notion in Information Science. Part III: Behavior and Effects of Relevance’, *Journal of the American Society for Information Science and Technology*, vol. 58, no. 13, pp. 2126-2144.

Savolainen, R. & Kari, J. 2006, ‘User-Defined Relevance Criteria in Web Searching’, *Journal of Documentation*, vol. 62, no. 6, pp. 685-707.

Savolainen, R. 2009, ‘Epistemic Work and Knowing in Practice as Conceptualizations of Information Use’, *Information Research*, vol. 14, no. 1. Retrieved 20 July 2011 from http://InformationR.net/ir/14-1/paper392.html.

Schamber, L. & Bateman, J. 1996, 'User Criteria in Relevance Evaluation: Toward Development of a Measurement Scale', in *Proceedings of the 59th Annual Meeting of the American Society for Information Science* (October 19-24). Retrieved 2 September 2011 from http://www.asis.org/annual-96/ElectronicProceedings/schamber.html.

Schamber, L., Eisenberg, M. B. & Nilan, M. S. 1990, 'A Re-Examination of Relevance: Toward a Dynamic, Situational Definition', *Information Processing & Management*, vol. 26, no. 6, pp. 755-766.

Seamans, N. H. 2002, 'Student Perceptions of Information Literacy: Insights for Librarians', *Reference Services Review*, vol. 30, no. 2, pp. 112-123.

Seok, B. 2006, 'Diversity and Unity of Modularity', *Cognitive Science*, vol. 30, no. 2, pp. 347-380.

Shank, G.D. 2006, *Qualitative Research: A Personal Skills Approach*, 2nd ed., Pearson, Upper Saddle River, NJ.

Shenton, A.K. 2007, 'The Paradoxical World of Young People's Information Behavior', *School Libraries Worldwide*, vol. 13, no. 2, pp. 1-17.

Shenton, A.K. & Dixon, P. 2003a, 'A Comparison of Youngsters' Use of CD-ROM and the Internet as Information Resources', *Journal of the American Society for Information Science and Technology*, vol. 54, no. 11, pp. 1029-1049.

Shenton, A.K. & Dixon, P. 2003b, 'Models of Young People's Information Seeking', *Journal of Librarianship and Information Science*, vol. 35, no. 1, pp. 5-22.

Siemens, G. 2006, *Knowing Knowledge*. Retrieved 6 February 2008 from http://www.elearnspace.org/kk1.pdf.

Simon, H.A. 1955, 'A Behavioral Model of Rational Choice', *The Quarterly Journal of Economics*, vol. 69, no. 1, pp. 99-118.

Simon, H. A. 1990, 'Invariants of Human Behavior', *Annual Review of Psychology*, vol. 41, pp. 1-19. Retrieved 12 June 2011 from http://wexler.free.fr/library/files/simon%20(1990)%20invariants%20of%20human%20behavior.pdf.

Simons, P. R.-J. 1993, 'Constructive Learning: The Role of the Learner', in *Designing Environments for Constructive Learning*, (NATO Advanced Science Institutes), Duffy, T.M., Lowyck, J. & Jonassen, D.H., with the assistance of Welsh, T.M. (Eds.), Springer-Verlag, Berlin, pp. 291-313.

Sormunen, E. & Lehtiö, L. 2011, 'Authoring Wikipedia Articles as an Information Literacy Assignment: Copy-Pasting or Expressing New Understanding in One's Own Words?', *Information Research*, vol. 16, no. 4. Retrieved 11 February 2012 from http://InformationR.net/ir/16-4/paper503.html.

Soman, D. 2004, 'Framing, Loss Aversion, and Mental Accounting', in *Blackwell Handbook of Judgment and Decision Making*, Koehler, D.J. & Harvey, N. (Eds.), Blackwell, Oxford, pp. 379-398.

Spink, A. & Cole, C. 2006,'Human Information Behavior: Integrating Diverse Approaches and Information Use', *Journal of the American Society for Information Science and Technology*, vol. 57, no. 1, pp. 25-35.

Spink, A., Greisdorf, H. & Bateman, J. 1998, 'From Highly Relevant to Not Relevant: Examining Different Regions of Relevance', *Information Processing and Management*, vol. 34, no.5, pp. 599-621.

Stake, R.E. 1998, 'Case Studies', in *Strategies of Qualitative Inquiry*, Denzin, N.K. & Lincoln, Y.S. (Eds.), Sage Publications, London, pp. 86-109.

Strauss, A. & Corbin, J. 1990, *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*, Sage, Newbury Park, California.

Strauss, A. & Corbin, J. 1998, 'Grounded Theory Methodology: An Overview', in *Strategies of Qualitative Inquiry*, Denzin, N.K. & Lincoln, Y.S. (Eds.), Sage Publications, London, pp. 158-183.

Sundin, O. & Francke, H. 2009, 'In Search of Credibility: Pupils' Information Practices in Learning Environments', *Information Research*, vol. 14, no. 4. Retrieved 10 April 2010 from http://InformationR.net/ir/14-4/paper418.html.

Svenson, O. 2003, 'Values, Affect, and Processes in Human Decision Making: A Differentiation and Consolidation Theory Perspective', in *Emerging Perspectives on Judgment and Decision Research*, Schneider, S.L. & Shanteau, J. (Eds.), Cambridge University Press, Cambridge, pp. 287-326.

Talja, S., Tuominen, K. & Savolainen, R. 2005, '"Isms" in Information Science: Constructivism, Collectivism and Constructionism', *Journal of Documentation*, vol. 61, no. 1, pp. 79-101.

Tang, M. 2009, 'A Study of Academic Library Users' Decision-Making Process: A Lens Model Approach', *Journal of Documentation*, vol. 65, no. 6, pp. 938-957.

Tang, R. & Solomon, P. 1998, 'Toward an Understanding of the Dynamics of Relevance Judgment: An Analysis of One Person's Search Behavior', *Information Processing & Management*, vol. 34, no. 2-3, pp. 237-256.

Tang, R. & Solomon, P. 2001, 'Use of Relevance Criteria Across Stages of Document Evaluation: On the Complementarity of Experimental and Naturalistic Studies', *Journal of the American Society for Information Science and Technology*, vol. 52, no. 8, pp. 676-685.

Tanni, M. & Sormunen, E. 2008, 'A Critical Review of Research on Information Behavior in Assigned Learning Tasks', *Journal of Documentation*, vol. 64, no. 6, pp. 893-914.

Taraborelli, D. 2008, 'How the Web is Changing the Way We Trust', in Briggle, A., Waelbers, K., & Brey, P. (Eds.), *Current Issues in Computing and Philosophy*, IOS Press, Amsterdam, pp. 194-204. Also available at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.96.4292&rep=rep1&type=pdf.

Taylor, A. 2012, 'A Study of the Information Search Behaviour of the Millennial Generation', *Information Research,* vol. 17, no. 1. Retrieved 1 April 2012 from http://InformationR.net/ir/17-1/paper508.html.

Taylor, A.R., Cool, C., Belkin, N. J. & Amadio, W.J. 2007, 'Relationships Between Categories of Relevance Criteria and Stage in Task Completion', *Information Processing & Management,* vol. 43, no. 4, pp. 1071-1084.

Taylor, A., Zhang, X. & Amadio, W.J. 2009, 'Examination of Relevance Criteria Choices and the Information Search Process', *Journal of Documentation,* vol. 65, no. 5, pp. 719-744.

Todd, P.M. & Gigerenzer, G. 2000, 'Précis of *Simple Heuristics That Make Us Smart*', *Behavioral and Brain Sciences,* vol. 23, no. 5, pp. 727-741.

Todd, R.J. 2003, 'Theme Section: Adolescents of the Information Age: Patterns of Information Seeking and Use, and Implications for Information Professionals', *School Libraries Worldwide,* vol. 9, no. 2, pp. 27-46.

Todd, R.J. 2006, 'From Information to Knowledge: Charting and Measuring Changes in Students' Knowledge of a Curriculum Topic', *Information Research,* vol. 11, no. 4, paper 264. Retrieved 18 February 2008 from http://InformationR.net/ir/11-4/paper264.html.

Tombros, A., Ruthven, I. & Jose, J.M. 2005, 'How Users Assess Web Pages for Information Seeking', *Journal of the American Society for Information Science and Technology,* vol. 56, no. 4, pp. 327-344.

Tseng, S., & Fogg, B. J. 1999. 'Credibility and Computing Technology', *Communications of the ACM,* vol. 42, no. 5, pp. 39-44.

Tu, Y.-W., Shih, M. & Tsai, C.-C. 2008, Eighth Graders' Web Searching Strategies and Outcomes: The Role of Task Types, Web Experiences and Epistemological Beliefs', *Computers & Education,* vol. 51, no. 3, pp. 1142-1153.

Twait, M. 2005, ‘Undergraduate Students’ Source Selection Criteria: A Qualitative Study’, *The Journal of Academic Librarianship*, vol. 31, no. 6, pp. 567-573.

University of Southern California. Annenberg School for Communication & Journalism. 2010, *World Internet Project Report Finds Large Percentages of Non-Users, and Significant Gender Disparities in Going Online*. Retrieved 4 September 2011 from http://www.digitalcenter.org/WIP2010/wip2010_long_press_release_v2.pdf.

University of Southern California. Annenberg School for Communication & Journalism. 2011, *Tenth Study by the Digital Future Project Finds High Levels of Concern about Corporate Intrusion in Personal Lives*. Retrieved 4 September 2011 from http://www.worldinternetproject.net/_files/_News/37/2011_digital_future_final_release.pdf.

University of Southern California. Annenberg School for Communication & Journalism. Center for the Digital Future. 2011, *Surveying the Digital Future: A Longitudinal International Study of the Individual and Social Effects of PC/Internet Technology*. Retrieved 4 September 2011 from http://www.digitalcenter.org/pages/site_content.asp?intGlobalId=22.

Urquhart, C. & Rowley, J. 2007, ‘Understanding Student Information Behavior in Relation to Electronic Information Services: Lessons From Longitudinal Monitoring and Evaluation, Part 2’, *Journal of the American Society for Information Science and Technology*, vol. 58, no. 8, pp. 1188-1197.

Vakkari, P. 2001, ‘Changes in Search Tactics and Relevance Judgements When Preparing a Research Proposal: A Summary of the Findings of a Longitudinal Study’, *Information Retrieval*, vol. 4, no. 3/4, pp. 295-310.

Vakkari, P. & Hakala, N. 2000, ‘Changes in Relevance Criteria and Problem Stages in Task Performance’, *Journal of Documentation*, vol. 56, no. 5, pp. 540-562.

Vakkari, P. & Sormunen, E. 2004, ‘The Influence of Relevance Levels on the Effectiveness of Interactive Information Retrieval’, *Journal of the American Society for Information Science and Technology*, vol. 55, no. 11, pp. 963-969.

Valentine, B. 2001, 'The Legitimate Effort in Research Papers: Student Commitment versus Faculty Expectations', *Journal of Academic Librarianship*, vol. 27, no. 2, pp. 107-115.

Valenza, J.K. 2006, 'They Might be Gurus', *Teacher Librarian*, vol. 34, no. 1, pp. 18-26.

Veenman, M.V.J,. Van Hout-Wolters, B.H.A.M. & Afflerbach, P. 2006, 'Metacognition and Learning: Conceptual and Methodological Considerations', *Metacognition and Learning*, vol. 1, no. 1, pp. 3-14.

Walraven, A., Brand-Gruwel, S. & Boshuizen, H.P.A. 2009, 'How Students Evaluate Information and Sources When Searching the World Wide Web for Information', *Computers & Education*, vol. 52, no. 1, pp. 234-246.

Walton, M. & Archer, A. 2004, 'The Web and Information Literacy: Scaffolding the Use of Web Sources in a Project-Based Curriculum', *British Journal of Educational Technology*, vol. 35, no. 2, pp. 1-14. Retrieved 9 February 2008 from http://www.cet.uct.ac.za/files/KnowledgeBase/2004ResearchOutput/bjet_4_Walton_Archer.pdf.

Wang, P. & Soergel, D. 1998, 'A Cognitive Model of Document Use During a Research Project. Study I. Document Selection', *Journal of the American Society for Information Science and Technology*, vol. 49, no. 2, pp. 115-133.

Wang, P. & White, M.D. 1999, 'A Cognitive Model of Document Use during a Research Project. Study II. Decisions at the Reading and Citing Stages', *Journal of the American Society for Information Science*, vol. 50, no. 2, pp, 98-114.

Wang, Y. 2007, 'Riding to the Future: An Investigation of Information Literacy Skills of Students at an Urban University as Applied to the Web Environment', *International Journal on E-Learning*, vol. 6, no. 4, pp. 593-603.

Warwick, C., Rimmer, J., Blanford, A., Gow, J. & Buchanan, G. 2009, 'Cognitive Economy and Satisficing in Information Seeking: A Longitudinal Study of Undergraduate Information Behavior', *Journal of the American Society for Information Science and Technology*, vol. 60, no. 12, pp. 2402-2415.

Wathen, C.N. & Burkell, J. 2002, 'Believe It or Not: Factors Influencing Credibility on the Web', *Journal of the American Society for Information Science and Technology*, vol. 53, no. 2, pp. 134-144.

Watson, C.L. 2010, 'A Study of Secondary Students' Decision-Making Processes With Respect to Information Use, Particularly Students' Judgements of Relevance and Reliability', *International Association of School Librarianship, Selected Papers from the ... Annual Conference* (Brisbane, Australia, September 27 - October 1), pp. 1-17.

Watson, J.S. 2004, '"If You Don't Have It, You Can't Find It": A Close Look At Students' Perceptions of Using Technology', in *Youth Information-Seeking Behavior: Theories, Models, and Issues*, Chelton, M.K. & Cool, C. (Eds.), Scarecrow, Lanham, Maryland, pp. 145-180.

Weber, E.U. & Johnson, E.J. 2009, 'Mindful Judgment and Decision Making', *Annual Review of Psychology*, vol. 60, pp. 53-85.

Weinstein, M. 2004, *TAMS and TAMS Analyzer*. Retrieved 2 March 2008 from http://tamsys.sourceforge.net/.

Westbrook, L. 2006, 'Mental Models: A Theoretical Overview and Preliminary Study', *Journal of Information Science*, vol. 32, no. 6, pp. 563-579.

Whitmire, E. 2003, 'Epistemological Beliefs and the Information-Seeking Behavior of Undergraduates', *Library & Information Science Research*, vol. 25, pp. 127-142.

Whitmire, E. 2004, 'The Relationship Between Undergraduates' Epistemological Beliefs, Reflective Judgment, and Their Information-Seeking Behavior', *Information Processing & Management*, vol. 40, no. 1, pp. 97-111.

Wilks, J. 2008, 'Blinded by Technology?' *IE* [*Independent Education*], vol. 38, no. 1, pp. 10-12.

Williamson, K. & McGregor, J.H. 2006, 'Information Use and Secondary School Students: A Model for Understanding Plagiarism', *Information Research*, vol. 12, no. 1, pp. [1-13]. Retrieved 17 January 2008 from http://InformationR.net/ir/12-1/paper288.html.

Wilson, T.D. 1981, 'On User Studies and Information Needs', *Journal of Documentation*, vol. 37, no. 1, pp. 3-15.

Wilson, T.D. 1999, 'Models in Information Behaviour Research', *Journal of Documentation*, vol. 55, no. 3, pp. 249-270. Retrieved 3 September 2011 from http://informationr.net/tdw/publ/papers/1999JDoc.html.

Wilson, T.D. 2003, 'Philosophical Foundations and Research Relevance: Issues for Information Research', *Journal of Information Science*, vol. 29, no. 6, pp. 445-452.

Wilson, T.D. 2006, 'On User Studies and Information Needs', *Journal of Documentation*, vol. 62, no. 6, pp. 658-670.

Wilson, T.D. 2010, 'Fifty Years of Information Behavior Research', *Bulletin of the American Society for Information Science and Technology*, vol. 36, no. 3**,** pp. 27-34.

Wolfe, M. B. W. & Goldman, S. R. 2005, 'Relations Between Adolescents' Text Processing and Reasoning', *Cognition and Instruction*, vol. 23, no. 4, pp. 467–502.

Wolters, C.A. 2003, 'Regulation of Motivation: Evaluating an Underemphasized Aspect of Self-Regulated Learning', *Educational Psychologist*, vol. 38, no. 4, pp. 189-205.

Xu, Y. & Chen, Z. 2006, 'Relevance Judgment: What Do Information Consumers Consider Beyond Topicality?', *Journal of the American Society for Information Science and Technology*, vol. 57, no. 7, pp. 961–973.

Xu, Y., Tan, B.C.Y. & Yang, L. 2006, 'Who Will You Ask? An Empirical Study of Interpersonal Task Information Seeking', *Journal of the American Society for Information Science and Technology*, vol. 57, no. 12, pp. 1666-1677.

Xu, Y. & Yin, H. 2008, 'Novelty and Topicality in Interactive Information Retrieval', *Journal of the American Society for Information Science and Technology*, vol. 59, no. 2, pp. 201-215.

Zipf, G.K. 1949, *Human Behavior and the Principle of Least Effort: An Introduction to Human Ecology*, Hafner, New York.

Zsambok, C.E. 2005, 'Naturalistic Decision Making: Where Are We Now?' in *Naturalistic Decision Making*, Zsambok, C.E. & Klein, G. (Eds.), Lawrence Erlbaum Associates, Mahwah, New Jersey, pp. 3-16.

APPENDICES

Appendix 3.1: Information sheet for participants and parents/guardians, and associated assent and consent forms (Study 1)

School of Education

Armidale, NSW 2351 Australia

Telephone [Int'l + 61 2] (02)6773 4221/6773 2560

Fax [Int'l + 61 2] (02)6773 2445/6773 5078

Information Sheet for Participants and Their Parents/Guardians

Researching the Information Search Process of Students

Research associate
Curtis Watson
(Qualifying Ed.D student)
[Name of school]
Phone: (02) [number]
Email: curtis.watson@[name of school].[jurisdiction].edu.au

Research supervisors
Dr Mike Littledyke (Principal supervisor)
University of New England
Phone (02) 6773 2509
Email: michael.littledyke@une.edu.au

Mitchell Parkes (Supervisor)
University of New England
Phone: (02) 6773 5082
Email: mparkes2@une.edu.au

Research is being carried out into the information search process of students, which is the process they go through when finding and using information for writing a report (often an essay) or preparing a presentation.

The research project will study students' learning strategies. It will look particularly at the strategies that students use when undertaking a typical research task. Some aspects that will be focused on are:

- how students find and use reliable, relevant information;
- their thinking processes, such as how they make sense of the information; and
- the feelings they experience during the process, such as anxiety, confidence, optimism, frustration, and a sense of satisfaction at completing the task.

Students are free to decide whether they take part in the study or not. They are able to change their minds during the study for whatever reason and stop taking part at any point. There will be no penalty for students who choose not to participate.

Many teachers, and parents, are concerned that some students appear to go no further than what a Google search reveals or what a Wikipedia article contains. This research project will look at the level of development of students' methods for finding and using information effectively. Results of the research will help to identify the types of instruction that may assist teachers to support students to become better learners.

Little research has been done into the strategies that Australian students employ when engaged in research tasks at school. Our knowledge of the information search process (ISP) is based largely on overseas studies and anecdotal evidence. This is an opportunity for Australian students to help teachers gain a better understanding of the process.

Students will be asked to complete three questionnaires: one when they have selected a topic for research, a second when they have formed a focus for their research, and a third when they have completed their research. The questionnaires will survey the following: students' level of knowledge about their topic; their level of interest in it; and what they have found easy and difficult about their research to that point.

About half the students in the class group will be interviewed. Interviews will be held in the school library. The topics covered in the interview, which will be audio-recorded for later transcription, will include these aspects:

- what motivated them to choose their topic;
- what they were most satisfied with, and most challenged by, in their research work;
- what they learned from doing the assignment;
- how they learned; and
- the level and type of assistance they received, or would like to have received, from teachers and teacher librarians.

In addition to data from the questionnaires and interviews, data will also be gathered from the journals that students have kept as part of an assessment requirement. A form supplied with this sheet asks that students assent, and parents/guardians consent, to the use of data from these three sources.

Data will be kept confidential; only the research associate and the subject teacher will have access to the identity of the individual contributing the data. Any reports relating to the research will be of aggregated data with no individual's identity or that of the participating school revealed. Where an individual's contribution is used for illustrative purposes in a report, the participant will be referred to by a code known only to the research associate.

It is unlikely that students will be upset by taking part in this research but, if they are, they should talk to a parent or teacher about it and, if necessary, ask for advice about counselling.

Any paper-based data will be stored in a locked filing cabinet in the research associate's office or home; any data in digital form will be accessible only to the research associate and authorised IT staff via secure login. Data will be stored for no longer than five years. All data will be appropriately destroyed or deleted at the end of five years.

Research data for the pilot study are expected to have been gathered by the end of November 2007. Results are expected to be available by the end of July 2008. Participants are welcome to contact the research associate at this time to access the results.

Mr Curtis Watson, currently Head of Library at [Name of school], will carry out the research under the supervision of the University of New England. If you have any questions, please contact him by email at curtis.watson@[name of school].[jurisdiction].edu.au or by phone on (02) [number].

This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No. HE07/181; valid to 24/10/2008)

Should you have any complaints concerning the manner in which this research is conducted, please contact the Research Ethics Officer at the following address:

Research Services
University of New England
Armidale, NSW 2351.
Telephone: (02) 6773 3449 Facsimile (02) 6773 3543
Email: Ethics@une.edu.au

If you have any questions or concerns regarding this study, please feel free to contact the research supervisors, Dr Mike Littledyke, Lecturer, Science Education on 6773 2506 (michael.littledyke@une.edu.au) or Mitchell Parkes, Lecturer ICT Education on 6773 5082 (mparkes2@une.edu.au).

Participants should retain this information sheet for their reference.

School of Education

Armidale, NSW 2351 Australia

Telephone [Int'l + 61 2] (02)6773 4221/6773 2560

Fax [Int'l + 61 2] (02)6773 2445/6773 5078

Assent Form for Participants and Consent Form for Their Parents/Guardians

Researching the Information Search Process of Students

Research associate
Curtis Watson
(Qualifying Ed.D student)
[Name of school]
Phone: (02) [number]
Email: curtis.watson@[name of school].[jurisdiction].edu.au

Research supervisors
Dr Mike Littledyke (Principal supervisor)
University of New England
Phone (02) 6773 2509
Email: michael.littledyke@une.edu.au

Mitchell Parkes (Supervisor)
University of New England
Phone: (02) 6773 5082
Email: mparkes2@une.edu.au

Students, please complete and return to Mr Watson:

I …….. (the participant) have read the Information Sheet for Participants and Their Parents/Guardians. Any questions I have asked have been answered to my satisfaction. I agree to participate in this activity, realising that I may withdraw at any time. I agree that research data gathered for the study from the questionnaires, interviews and journals may be published, provided my name is not used.

• ……	……	
	Participant	Date
• ……	……	
	Investigator	Date

Parents/Guardians, please complete and return to Mr Watson:

I …….. (the parent/guardian of the participant) have read the Information Sheet for Participants and Their Parents/Guardians. Any questions I have asked have been answered to my satisfaction. I agree to allow my son/daughter to participate in this activity, should he/she agree to do so, realising that he/she may withdraw at any time. I agree that research data gathered for the study from the questionnaires, interviews and journals may be published, provided my child's name is not used.

• …….	……	
	Parent/Guardian	Date
……	……	
Investigator	Date	

Appendix 3.2: Information sheet for participants and parents/guardians, and associated assent and consent forms (Study 2)

(*Note*: Participants were, subsequent to the production of the form below, not asked to complete questionnaires or to contribute journals; that is, they took part in interviews only.)

School of Education

Armidale, NSW 2351 Australia

Telephone [Int'l + 61 2] (02)6773 4221/6773 2560

Fax [Int'l + 61 2] (02)6773 2445/6773 5078

Information Sheet for Participants and Their Parents/Guardians

Researching the Information Search Process of Students

Research associate
Curtis Watson
(Doctoral student)
[Name of school]
Phone: (02) [number]
Email: curtis.watson@[name of school].[jurisdiction].edu.au

Research supervisors
Dr Mike Littledyke (Principal supervisor)
University of New England
Phone (02) 6773 2509
Email: michael.littledyke@une.edu.au

Mr Mitchell Parkes (Supervisor)
University of New England
Phone: (02) 6773 5082
Email: mparkes2@une.edu.au

Research is being carried out into the information search process of students, which is the process they go through when finding and using information for writing a report (often an essay) or preparing a presentation.

The research project will study students' learning strategies. It will look particularly at the strategies that students use when undertaking a typical research task. Some aspects that will be focused on are:

- how students find and use reliable, relevant information;
- their thinking processes, such as how they make sense of the information; and
- the feelings they experience during the process, such as anxiety, confidence, optimism, frustration, and a sense of satisfaction at completing the task.

Students are free to decide whether they take part in the study or not. They are able to change their minds during the study for whatever reason and stop taking part at any point. They may elect to contribute to all or some of the types of data being collected. There will be no penalty for students who choose not to participate.

Many teachers, and parents, are concerned that some students appear to go no further than what a Google search reveals or what a Wikipedia article contains. This research project will look at the level of development of students' methods for finding and using information effectively. Results of the research will help to identify the types of instruction that may assist teachers to support students to become better learners.

Little research has been done into the strategies that Australian students employ when engaged in research tasks at school. Our knowledge of the information search process (ISP) is based largely on overseas studies and anecdotal evidence. This is an opportunity for Australian students to help teachers gain a better understanding of the process.

Students will be asked to complete a questionnaire, which will survey their experiences of the research process. Participating students will also be interviewed. Interviews will be held in the school library. The topics covered in the interview, which will be audio-recorded for later transcription, will include such aspects as:

- their topic and what motivated them to choose it;
- the course their research work took;
- what they learned from doing the assignment and how they learned it.

In addition to data from the questionnaires and interviews, data will also be gathered from the journals that students will keep as part of an assessment requirement. As a way of stimulating recall during interview, some online search activities will be recorded. A form supplied with this sheet asks that students assent, and parents/guardians consent, to the use of data from these sources; some may wish to contribute selectively to these sources.

Data will be kept confidential; only the research associate and the subject teacher will have access to the identity of the individual contributing the data. Any reports relating to the research will be of aggregated data with no individual's identity or that of the participating school revealed. Where an individual's contribution is used for illustrative purposes in a report, the participant will be referred to by a pseudonym known only to the research associate.

It is unlikely that students will be upset by taking part in this research but, if they are, they should talk to a parent or teacher about it and, if necessary, ask for advice about counselling.

Any paper-based data will be stored securely in the research associate's office or home; any data in digital form will be accessible only to the research associate and authorised IT staff via secure login. Data will be stored for no longer than five years. All data will be appropriately destroyed or deleted at the end of five years.

Research data for the study are expected to have been gathered by the end of September 2008. Results are expected to be available by mid-2009. Participants are welcome to contact the research associate at this time to access the results.

Mr Curtis Watson, currently Head of Library at [Name of school], will carry out the research under the supervision of the University of New England. If you have any questions, please contact him by email at curtis.watson@[name of school].[jurisdiction].edu.au or by phone on (02) [number].

This project has been approved by the Human Research Ethics Committee of the University of New England (Approval No. HE07/181; valid to 24/10/2008). Should you have any complaints concerning the manner in which this research is conducted, please contact the Research Ethics Officer at the following address:

Research Services
University of New England
Armidale, NSW 2351.
Telephone: (02) 6773 3449 Facsimile (02) 6773 3543
Email: Ethics@une.edu.au

If you have any questions or concerns regarding this study, please feel free to contact the research supervisors, Dr Mike Littledyke, Lecturer, Science Education on 6773 2506 (michael.littledyke@une.edu.au) or Mr Mitchell Parkes, Lecturer ICT Education on 6773 5082 (mparkes2@une.edu.au).

Participants should retain this information sheet for their reference.

(*Note*: The appendix continues on the next page.)

School of Education

Armidale, NSW 2351 Australia

Telephone [Int'l + 61 2] (02)6773 4221/6773 2560

Fax [Int'l + 61 2] (02)6773 2445/6773 5078

Assent Form for Participants and Consent Form for Their Parents/Guardians

Researching the Information Search Process of Students

Research associate
Curtis Watson
(Doctoral student)
[Name of school]
Phone: (02) [number]
Email: curtis.watson@[name of school].[jurisdiction].edu.au

Research supervisors
Dr Mike Littledyke (Principal supervisor)
University of New England
Phone (02) 6773 2509
Email: michael.littledyke@une.edu.au

Mr Mitchell Parkes (Supervisor)
University of New England
Phone: (02) 6773 5082
Email: mparkes2@une.edu.au

Students, please complete and return to Mr Watson:

I …….. (the participant) have read the Information Sheet for Participants and Their Parents/Guardians. Any questions I have asked have been answered to my satisfaction. I agree to participate in this activity, realising that I may withdraw at any time. I agree that research data gathered for the study from questionnaires, interviews, online searches, and research journals may be published, provided my name is not used.

• Participant ……	Date ……
• Investigator ……	Date ……

Parents/Guardians, please complete and return to Mr Watson:

I …….. (the parent/guardian of the participant) have read the Information Sheet for Participants and Their Parents/Guardians. Any questions I have asked have been answered to my satisfaction. I agree to allow my son/daughter to participate in this activity, should he/she agree to do so, realising that he/she may withdraw at any time. I agree that research data gathered for the study from questionnaires, interviews, online searches, and research journals may be published, provided my child's name is not used.

• Parent/Guardian ……..	Date ……
• Investigator ……	Date ……

Appendix 3.3 Request to parents, by email, for consent (Study 2)

Dear Parents,

I'm undertaking research work through the University of New England into the strategies students use to do their research for assignments. The students in Mr [teacher's name]'s Year 9 History class and his Year 10 History class have been proposed as two groups of students whose research activities may be investigated.

I recall having met some of you at the Assisting With Assignments evenings held at [name of school]. The concerns expressed by parents at these evenings form part of my motivation for wanting to find out more about what learning strategies students employ in this part of their academic lives. (I've also met some of you through debating, some of you are my colleagues, and one of you works with one of my sons!)

Would you please take a few minutes to read the attachments [Appendix 3.2 above constitutes the attachments], which give further details about my research work. One attachment is a formal request to consider allowing your child to take part; the other is an information sheet. (We will probably not ask students to submit any learning journal entries so please ignore references in the attached documents to a journal.)

I would appreciate it if you were able to respond in the next week or so, either in the affirmative or negative. Would you mind replying by email initially and then sending back any affirmative responses with your child to drop off at the Library, or faxing them to [fax number]. Please let me have any questions (my contact details are below).

I hope you feel that this is a worthwhile project in which your child could participate. Participation will be in normal class time.

Regards,
Curtis.

Curtis Watson
[Position]
[Name and address of school]

Phone: [number]
Email: [address]

Appendix 3.4 Request emailed to parents for ongoing consent (Study 3)

Thank you for agreeing to let [name of student] participate in the research I was doing last year into the strategies students use to do their research for assignments. [Name of student]'s insights into the research process were very helpful and [his/her] interview gave very useful data.

With your permission, I would like to approach [name of student] to ask [his/her] permission to gather more data. This would entail the video-recording of about 20 minutes of computer-based work being done for any school assignment followed by a 20-minute interview in which I would ask [name of student] about the decisions [he/she] made about the relevance and the reliability of the information that [he/she] had found and used.

The ongoing research has been approved by the University of New England's Ethics Committee and the consent given last year should cover this situation. However, because almost a year has elapsed, I thought it best to ask whether you would be prepared to 'refresh' your approval by email.

Regards,
Curtis Watson.

Appendix 3.5: Request to students for ongoing participation (Study 3)

(*Note*: These requests were sent via students' tutors.)

Dear [*Name of student*],

You may know that I emailed a parent earlier in the term and asked if they would be happy for me to approach you to take part in the research that I'm doing. I certainly appreciated your input about a year ago and look forward to finding out more about how students tackle their research assignments.

Now that a parent has consented, I wanted to check with you if you are happy to take part. If you are, would you please let me know? We would then work out a time to meet.

If you have an assignment that you're currently working on, or one that you will be working on later this term, it would be good to use that for recording a 20-minute segment of computer-based activity. If you like, I could negotiate with one of your teachers for you to use part of a period for the recording and the interview immediately afterwards.

I look forwarding to hearing from you.

Regards,
Mr Watson.

Appendix 3.6: Journal writing guidelines (Study 1)

Contemporary Issues: History Today

Guidelines for keeping a journal

Your journal should contain clear descriptions of **what** you did, **how** you did things and **why** you did things related to your research task.

You should describe your actions, thoughts and feelings in as much detail as you can. Imagine that you are giving a running commentary on your experiences as you 'journey' through the requirements of the task. A reader should be able to 'hear' you thinking aloud.

Your journal should show that you have thought about what you are doing. It should contain descriptions as well as explanations.

Your journal will not be judged by whether you have done something 'correctly' or not. Be honest: report on what went wrong as well as what went right. If you have been doing something one way and then change the way you do it, this is important information to include in the journal. In such a case, explain clearly why you think your new way of doing something will be more effective. You may also, once you have completed the research task, think of a different way of doing something that you did. If this happens, include it in your journal.

As you go along, think about **what** you are learning and **how** you are learning. Are you learning new information? How are you connecting new information with old information? Are you learning new ways of doing things or perhaps making slight changes to the way you did something in the past? Do you find that you have changed your opinion or attitude towards some issue? Refer to these experiences in your journal.

Write the date at the beginning of each entry. Use sentences as much as possible; avoiding using points. If you do use points, be sure that they are not too brief and can easily be understood.

Here are some ways of starting a sentence in your journal:

- I have chosen the topic of … because …
- Today I was successful at …
- I tried … but it didn't work out, so I tried …
- What I need to do now is …
- If I do …, I think the effect will be …
- I found out that …
- I feel …
- … made me change the way I think about …
- Next time I do a task like this, I will …

Assessment criteria: The journal will be assessed using the rubric below:

	5 Very high	4 High	3 Moderate	2 Low	1 Very low or absent
Clarity of description of actions, thoughts and feelings					
Level of detail in descriptions					
Relevance to task-related activities					
Evidence of reflection on task(s) or insight related to task					
Evidence of development of learning (acquisition of new knowledge, attitudes or skills)					

Form: While most students will keep a written journal, there may be some who would like to negotiate a different way of recording their experiences. A spoken word journal is an option, as long as technical standards of recording are of an acceptable standard.

Length: This will be negotiated in class. Write here the results of that negotiation:

……500 words minimum, no maximum……

Appendix 3.7: Interview questions (Study 1)

The interview in Study 1 used the broad topics below as a guide. In line with a semi-structured interview, neither the wording of questions related to these topics, nor the order in which they were asked, was fixed (Minichiello, Aroni, Timewell, & Alexander, 1995:65). There was also no attempt to slavishly cover all the topics below.

Topics

- Factors that motivated students to choose their topic.
- Elements of their research work with which students were most satisfied, and those that they found most challenging.
- What students learned from doing the assignment, whether in relation to informational content or research techniques.
- How students learned.
- The level and type of assistance students received, or would like to have received, from teachers and teacher librarians.

Appendix 3.8: Questionnaires (Study 1)

I used Kuhlthau and Todd's (2007) 'SLIM Toolkit', administering 'Reflection Sheet 1' and 'Reflection Sheet 2' at the beginning and midpoint of students' ISP, respectively. However, I analysed only data relating to two questions, Question 4 and Question 5 in each of these two questionnaires. Questions 4 and 5 on the two reflection sheets are very similar. I foreshadowed to students that the questions on the second sheet would be very similar but that they needed to be answered in relation to where they were in their ISP and that it was likely that what they were finding easy and difficult, respectively, had changed.

- From 'Reflection Sheet 1':

4. When you do research, what do you generally find easy to do? Please list as many things as you like.

5. When you do research, what do you generally find difficult to do? Please list as many things as you like.

- From 'Reflection Sheet 2':

4. Thinking of your research so far, what did you find easy to do? Please list as many things as you like.

5. Thinking of your research so far, what did you find difficult to do? Please list as many things as you like.

Appendix 3.9: Interview questions (Study 2)

(Adapted from: Whitmire, E. 2003, 'Epistemological Beliefs and the Information-Seeking Behavior of Undergraduates', *Library & Information Science Research*, vol. 25, p. 141.)

1. Tell me about your research assignment. What is it about? What, or how much, did you know about the topic before beginning your research?

2. How did you decide to investigate this particular topic?

3. Let's draw an imaginary time line of the project so that we can talk about things you did in sequence. I'm interested in the steps you took that didn't work out, as well as the things that did. How did you get started?

4. Can you identify any points in the project when your research took a sudden turn?

5. Thinking about sources you used, how did you find the information that you needed?

6. What sources of information were most useful?

7. How did you decide which sources were good for your research assignment? What factors did you use to judge whether a source was good or not?

8. If you came across sources that you disagreed with, or two sources that contradicted each other, how did you handle that?

9. What factors (for example, people or things) played the most important role in developing your research assignment?

10. Would you do any part of the process differently? Did you learn anything of value along the way to improve the way you approach research assignments?

11. Is there anything else about your research experiences that we have not talked about?

Appendix 3.10: Interview schedule

Date	***Participant***	***Interview duration (minutes)***	***Scholastic year***
1 November 2007	Maria	11	11
	Jenny	7	11
	Lily	8	11
5 November 2007	Noah	9	11
	Brian	10	11
	Vicki	9	11
16 November 2007	Daniel	14	11
	Kelvin	11	11
	Kathy	13	11
20 November 2007	Ryan	17	11
29 November 2007	Louise (teacher)	33	NA
12 September 2008	Sophie	11	9
	Richard	12	9
	Amber	15	9
16 September 2008	Kristian	15	9
	Chloe	17	9
	Victoria	16	10
	Elizabeth	13	10
18 September 2008	Jake	13	10
	Emily	19	10
19 September 2008	Michael	19	10
	Charlotte	17	10
	Karen	18	10
24 September 2008	Mark	20	10
27 August 2009	Victoria	16	11
	Mary-Ann	24	11
28 August 2009	Chloe	20	10
4 September 2009	Karen	16	11
9 September 2009	Sharon	28	11
24 September 2009	Rachel	18	10
15 March 2010	Paul	22	11
23 August 2010	Edward	22	11
27 August 2010	Stefano	25	11
2 September 2010	Sophie	20	11
3 September 2010	Gerard	22	11
10 September 2010	Paul (2nd contribution)	18	11
14 September 2010	Lionel	11	11

Appendix 3.11: Participants' comments on study's methods

Case	*A : Methodology*
1 : Jenny Study 1 Year 11 Female	I: You know how I've been using interviews and questionnaires and journals to try and gather some information about how people do their research. Do you think these are good ways or do you have any, you know, do you have any comment about the ways I've been doing this P: I think the interview's a good idea. Um, sometimes the qu…, um, no, I think it's good, I think you've got a pretty wide, I can't think of any other way you could find out really.
2 : Kathy Study 1 Year 11 Female	P: Ah, I think it's good, the interviewing lots of different people because everyone's going to have a different method, everyone's going to use something I:Uh huh. P: Different, so that's good
3 : Lily Study 1 Year 11 Female	P: I'd say questionnaires, but did they not work very well, or … ? P: I'd say get a um, yeah, get a questionnaire and give it to tutor groups or something and get the tutors to make them fill it out and just have questions like, you know, 'Do you use books over Internet or how, like, how many sites do you go to to, and if you like compare information against other sources to see if it's right like especially with something that you actually need the correct facts P: Yeah, probably, I guess if people take it, like, seriously, and they write like what they do and stuff, it will give you a good idea.
4 : Vicki Study 1 Year 11 Female	P; I think the interview is a good method because you get people one-on-one and, um, I think they're more happy to share more information than down on paper and I think you can be a bit more articulate speaking, well, I feel more confident speaking rather than writing it down and I think it's probably easier for you to interpret what people are saying orally rather than written so I think the interview's a good way.
5 : Brian Study 1 Year 11 Male	I: One of the other things I'm asking people is, because this is a pilot study, and there's going to be a fuller investigation, probably next year, um, I'm asking them things about my approach to this, the way I'm collecting data, you know, through the interview, journals and questionnaires and things, what comments do you have about those methods P: Oh, well, I think it's a very good method, yeah, the interview and the journal, however, I think maybe you should give a sample journal of some of things like that you'd expect them to put, well, I know that that's maybe putting words into their head, but how expect them to structure it, like 'I went to Wikipedia and this is what I found' um, 'This is what I thought when I found it' I: So it would be more useful to give people a model P: A model of what they should be I: Not necessarily a model, because there's no exactly one right way to do it P: Oh yeah I: But an example of how one person might have done it P: yeah, 'cause, um, that might help you in getting what you really …, 'cause when I was writing it, yeah, I thought, mmm, I don't know exactly what he's looking for, I: Right P: I know he wants what I'm thinking,

Case	***A : Methodology***
6 : Daniel Study 1 Year 11 Male	P: I suppose the interview would be a lot more effective than just giving someone a bit of, a sheet of paper and getting them to tick it off 'cause a lot of the time that people do that, like I've just had one in Biology before, you just want to get it over with I: Uh huh P: And then you just put down 5 for every one I: Uh huh P: Just to get it over with, but I suppose with the interview it's a lot more effective, you do actually think about it a bit more so, yeah
7 : Kelvin Study 1 Year 11 Male	P: Um, I think the interview works quite well because, especially being high school kids, the least work, less work out of class you do the better, so and it's just a lot easier to just kind of rant about what you've done [laughter] P: it's just a lot easier to just kind of talk about it rather than write it down 'cause then when you write it down, you're going to think, aw, I haven't done that well and just I: Uh huh P: And, especially because this is more like on the spot so you can't well, maybe they won't want to hear I've only used Wikipedia [laughter], I'll change it a bit to all these impressive encyclopedias and books
8 : Noah Study 1 Year 11 Male	I: OK … one of the things that I'm asking people is what they think of, um, the methods that I'm using for gathering information about their research experiences and we've used, obviously, the interview we're using now and questionnaires and the journal […] are there any other ways or do you think these ways are successful and do you know of any other ways that may be useful? P: Well, I know that I'd use different research methods for other topics, like, for Contemporary Issues, you just want to get it done with and get a passable sort of mark whereas with History essays or seminars or anything then you, your researching is a bit different and more comprehensive I: Uh huh P:and so it would, kind of, I guess, produce skewed results doing it with Contemporary issues classes
9 : Ryan Study 1 Year 11 Male	P: Oh, it's a bit different to what we usually do, it's usually just here's the assignment, off you go do it, uh, it's good, you sort of have to think about how you're going to do the work a bit more, that's about it the interview, this is pretty good, you have to sort of work it out in your head, what you've been doing
10 : Lionel Study 3 Year 11 Male	P: Sorry, Mr Watson, when you're listening to this, it may be quite difficult to get onto the Internet now, which is somewhat frustrating [*Shows participant's awareness that he is producing data for the researcher*.]
11 : Sophie Study 3 Year 11 Female	P: Here I was like, um, I just put this in because I was talking in the thing and I was showing that you can, um, put in keywords and they'll come up [*Shows participant's awareness of research context, with a desire to exhibit a wider range of behaviours.*]

Case	*A : Methodology*
12 : Edward Study 3 Year 11 Male	I: Did you find this a reasonably easy thing to do, to talk, to give a running commentary as you went? P: Well, yeah, I mean every now and again I'll talk to myself when I do the assignment I: Ah, OK P: so it is, it is [?kinda] the same thing but with a little machine next to it
13 : Paul 2 Study 3 Year 11 Male	I: I just want to, this is like a theoretical model that I want to share with you and see if it fits in with what you think students do and what *you* do P: Yeah I: It's a three-stage model. It doesn't happen in sequence, in a linear fashion, but I think there are three things that happen. The students will look at a set of search results and they'll exclude things like abstracts of articles or sometimes books, even *Google Books* or, um, Amazon or something that sells books, and videos, any videos […], they seem to exclude all of that, and that seems to be one thing that they do P: Interestingly enough, I've found that sometimes, especially in one of my other subjects, Specialist B Maths, I find that I want to look for those abstracts from books because they, because most articles don't include very conceptual thoughts. In particular, in Specialist B Maths, everything is all very conceptual I: Specialist B Maths P: There're two lines of specialist, there's Specialist A, it's just very, you know, mechanical; all you need to remember is the formulas, but Specialist B is very conceptual, like how can the postman do this and that […] it's very interesting I: the postman P: how can he deliver all the mail in the shortest route possible, you know, and I find abstracts on the Web do help with that I: Right. OK P: And sometimes if you want to learn, I don't do this often, I've heard of people who've done it, is if they want to learn a subject really quickly, they go on YouTube, so for videos how to do that I: But then that'll be depending on someone presenting something on that topic P: Yeah I: OK, then the second thing I think people do is look at the, um, things like the title, the URL I: Definitely. P: the extract and so on

Case	A : Methodology
13 : Paul 2 Study 3 Year 11 Male [*continued from previous page]*	P: Where it comes from, that's true, yeah I: And they seem to be looking for how densely the keywords appear in, like, if the words in bold appear close to each other, they seem to be more attracted to those, 'cause P: That's true, yeah I: or to a Wikipedia article, *if* they're looking for an introduction P: Yeah, and it depends, it also depends on how relevant, sometimes they, the extract makes no sense with your wor-, selection of words, so you just don't' select it, yeah, so it's right, yeah, it's right I: OK. Then the third and final thing I think people do is when they're actually looking through an article they depend a lot on topic sentences in paragraphs P: Ooh, yeah I: They look at the introductory paragraph, they look at headings a lot to see if it's connected with their topic P: That's right I: And maybe they use Edit-Find to look for specific terms in each article. Does that seem P: Yeah, yeah I: logical and sort of P: That's right, yeah. I agree

Appendix 3.12: Affect (data extracts)

Case	*A : Affect*
1: Maria Study 1 Year 11 Female	It had pictures and stories it had pictures of victims of the Bosnian genocide and just some of the pictures they had were a bit like very kind of disturbing and I found pictures of, like, children with their heads chopped off and like stories of people who'd been burned alive and just all this horrible stuff that happened so that kind of freaked us out a little bit but um like reading up on it in the past
2: Vicki Study 1 Year 11 Female	I'd feel good if, um, someone in the class or a couple of people in the class came up to me and said, like, that was good, I really understand, I didn't really know that much before, I think that would make me feel satisfied and also I know that I know more about, I'd feel confident about how much I knew about the subject, and if I was able to go and talk to somebody else about what I'd learned, that kind of thing, so communicate it to somebody else
3: Brian Study 1 Year 11 Male	Went to the "Fisher space pen" website and found a section on how the space pen works and development history. It writes under water! Wow I didn't know that!
4: Daniel Study 1 Year 11 Male	I: Has it had any personal impact on you, doing this? P:Um, not really, just sort of like a bit of emotion, I suppose, when you look at the stuff that we've done to them and taken their land but then again, you think, like if it hadn't happened, we wouldn't be here, that sort of stuff, so it's a bit up and down if I think about it I: when it grows too far, do you get frustrated by that? P: Yeah, cause I have to, I have to look at stuff that won't be as relevant to the question and then I have to try and cut out the least important thing I: How do you feel when you have to cut things out? P:Frustrated [laughter] because I've got to rid of an idea that I thought, initially, was quite good, yeah
5: Kristian Study 2 Year 9 Male	P: I found this one website that I was … I went through all these other websites and collected little bits of information and it just kind of frustrated me a bit because then I found this one website that had all of it … it was like a big [*emphasised*] website just about the gold rush and I was kind of upset that I went through all the other ones and gathered little bits when I could've just gone to one but then I suppose I did cross-reference, which is good like I realise it's on two websites but then I usually seem to be more comfortable with writing [all/more?] about that because I believe it more I: How do you handle that? P: Probably get very frustrated and just look for a completely new one Compared to other assignments I've done, researching, it was less frustrating trying to find information because there was more information available

Case	*A : Affect*
6: Jake Study 2 Year 10 Male	I: what would you say the most influential factor in that assignment? P: Probably like the imagery, like the Ku Klux Klan, like just the whole idea of them I: Uh huh P: It's pretty disgusting I: So that's the one thing that grabbed your interest and P: aw, yeah, and sort of like the segregation as well I: Uh huh P: Yeah, like different restaurants and stuff
7: Chloe Study 3 Year 10 Female	I like dot orgs. Oh, that's a cool map, I'm writing that web page down as a reference […] I'll go on later and reference that [?to] the [name of school] website; got a pretty cool map there, I'm liking it, um, January the thirty-first, yes, got most of that, I'll write it down at the end, Jap [?Jan., as in January] the thirty-first, ooh, it's my grand-dad's birthday, 1942, the Japanese, er, 70 miles of the Singapore coastline lay vulnerable, ooh, that's massive
8: Lionel Study 3 Year 11 Male	Yeah, look, this isn't going to be all that easy, so I think I'm just not going to, I'll worry about it later disconnecting again, God, ah, that's so irrit-, ah, alright, this is bizarre, it's just opening up new pages.
9: Sharon Study 3 Year 11 Female	I: you left Britannica at that stage P: Yeah, 'cause it hadn't really helped. I: M-huh. Can you remember how you were feeling at that stage? P: Um, I guess I was feeling a bit like that was pointless I: M-huh. P: Yeah, why did I do that [*laughs*]?
10: Sophie Study 3 Year 11 Female	I: in terms of, like, confidence or frustration or optimism or anxiety, I mean, did you have any feelings like that? P: Oh, not really I: No? P: I'm not, I don't get very stressed about researching
11 : Edward Study 3 Year 11 Male	I: And the other thing is, can you remember any feelings you had about what you were doing? (21m 43s) P: A-o-h, at some points, a bit of sympathy, particularly when you're reading through some of the case, and you think […] especially with Martin Bryant, you read through his childhood and you couldn't help feel sympathetic; he was born to a loving family but somewhere along the road he just slipped off, so, um, that's kinda the main emotion but, apart from that, [?I guess] the main idea is to, you know, while I'm […?] take yourself away from that aspect of it

Case	*A : Affect*
12 : Gerard Study 3 Year 11 Male	I: This looks like quite a challenging P: Ah, yeah, yeah, it's good fun, though I: Did you ultimately find something satisfying? P: Um, I have a book on loan from the library but, other than that, there wasn't much satisfaction Um, with the image, I was a bit frustrated that it was in such a small definition because it was a big image but generally when you find geological maps online they're very, like, big, which is nice because they're very detailed but that was, yeah, frustration. Um, I think there might have been … a little bit of annoyance at, um, the guy who was, Gratton Wilson, that guy, I: Uh huh P: Because, you know, his river, his like farm is upstream of the thing and he's been taking water out of the system but he doesn't want other people to take water out of the system he's a bit of a hypocrite, I didn't really like him, but he's still a source, nonetheless I would've been a lot more satisfied if I could've found like an intellectual article or a journal article. That's why I was searching for A Pascoe's journal article a lot So it doesn't look like there's actually any journal articles on mining in Chakola, which is a bit annoying, so that means that all the research will come a lot tougher So I'm looking for the Silurian sequences, um, this is annoying. [*Annoyance apparently at lack of info; references to Silurian and Colinton Volcanics in statements, with no elaboration.*]
13 : Paul 1 Study 3 Year 11 Male	P: Frustration at the beginning when the computer wasn't working [*slowness in accessing Internet and getting past filtering software*], I get very easily frustrated with the computer, they're pretty horrible actually P: Pretty cheerful at the moment, when just searching. Right, that didn't work, let's try this I: Cheerful because you've P: Because the computer started working And then when I started reading it, yeah, a number of emotions, you say, ah, you, you kinda feel for the guy, you, you know, you like, oh, he's a nice guy, oh, wait, why did he do that, that was stupid, he shouldn't have done that, or why did you spend ten years on a court case just to get, or probably it meant a lot to him, but, you know, to me, I'm just like why did you do that, or wow, you're deaf and you still decide to keep composing, that's really quite amazing, it's, you know, like you're feeling for the composer and when you finish, like, ah, nice story definitely admiration's there, and empathy, yeah
14 : Paul 2 Study 3 Year 11 Male	P: I looked around a little bit but then my eyes, like I went back and start trying to find more referendum stuff and then I was like 'I don't get this', and closed it I: Right, so did you feel a little bit frustrated that you hadn't P: Yeah I: clarified the difference.

Case	*A : Affect*
15 : Stefano Study 3 Year 11 Male	a bit of a self-esteem boost because I know there's a lot of information now, I can actually get something done, it shouldn't take a very, very long time, so it's just a general topic I should be able to do, so there's lots of information, that's fantastic

Appendix 3.13: Samples of data analysed, showing categories assigned

M: I don't like numbers, random letters that don't mean anything, so I was a bit unsure about it

C: Right

M: So it turns out to be a good site

C: This one's sort of, well, you wonder why there's an 's' there but 1942 makes sense […] but obviously if there're about 9 or 12 numbers or more, I know what you mean

M: Those look like videos. I said I'd come back later and look at the videos

C: So you just make a mental note

M: Yeah [6m44s]

C: to go back, OK, because you feel you don't have time

M: Yeah

C: Would this have been the first map you've seen?

M: It was, so I wrote it down and said I'd come back for it

C: So, would you go to another map, do you think, or

M: Yeah, I'd do more, then after I did all my, like, websites, I'd probably go to Google Images

C: OK

M: But I didn't do that today

C: Fine, OK.

M: Normally I'd go into Google Images and then have a look at Google images of the stuff

C: Uh huh.

M: So I read all this – most of this, anyway

C: So you're scanning and skimming,

M: yeah

C: but can you remember what you were looking for, what were you thinking about paying attention to?

C: Right, so on what grounds do you feel that it's good. I mean, what tests do you apply?

L: Ah, I've got other information, I've got other websites, so generally the information tends to line up, it seems to be pretty good, so I just basically go off that and I also sometimes have books, um, yeah

C: So, for this Falklands War topic, is this, did you have anybackground knowledge

L: No, none

C: So what you're reading here now in this Wikipedia article is new information to you?

L: All new information

C: So, did you get, this afternoon, did you get around to checking, you used the word 'line up', did this information line up with anything else you found this afternoon?

L: Yeah, there're are a few other tabs all of general basic information, all tends to fit in quite well

C: Now, going back just briefly, you know before [...], the Wikipedia one came up as the first result, so, I mean, would you generally use the first result?

L: Um, no, not at all. It just, perchance, it was the first one so I went into it

C: So, if the Wikipedia, were you looking for the Wikipedia one?

L: Oh, it depends, because I'd only read the blurb, um, what's in it, and if it's not relevant, I just sort through everything and see what is relevant. Normally Wikipedia is quite relevant so it just happened to be the first one so I went into it

C: So, when you're deciding if it's relevant or not, do you know what your thinking process is there?

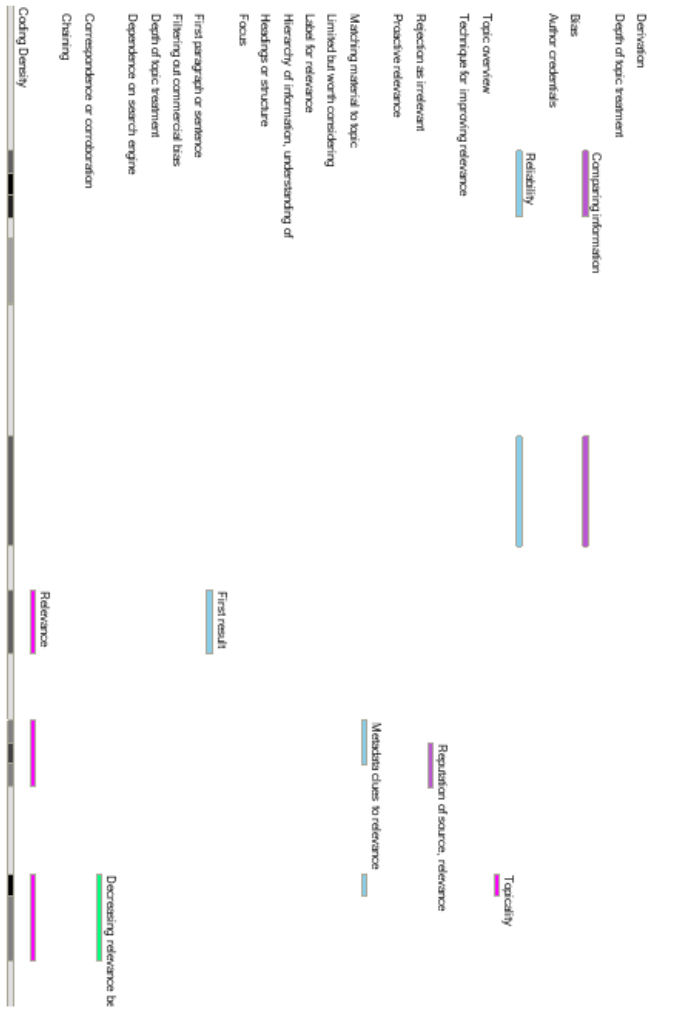
L: Um, I just try and find things that are related back to the question, the blurb [...] if I can't find anything, then I'll just move past. I generallydon't go past the first page of Google 'cause it tends to lose, um, what you're looking for [?down the ...] so why bother going to the next page?

C: Right, right. One student said that things become less relevant past the first page (5m 11s) or things become more vague

L: Yeah, that's, yeah, that's what I was trying to say

C: OK [...]. So you're opening a Word document now

L: Yep



2A

J: And then, yeah

C: put in that name [?from that citation]

J: [...] from the citation with the mine name

C: uh huh

J: And, um, and made sure that the reser-, result would be a bit narrower [...]

C: And you get one result – it's most unusual in Google

J: Yeah, it happens a bit with the Geology stuff unfortunately

C: So you tried that

J: So I went back to the other stream and it turned out that was a forum of just people's opinions, so

C: And did you reject that?

J: Well, yeah, people's opinions on analysis stuff generally aren't very good and so I went down again and had a look, um, had a look at that, but that turned out to be just the point of interest reference

C: Oh, this POIDB [...]

J: Then I went back to this stream and the link that one search result came back was all about just some person who lived in Cooma

C: Right, right

J: So, um, I was trying to find where it had the Chakola reference, I used the Control-F function

C: Oh, yes, like Edit-Find equivalent

J: Yeah and yeah I've realised that it just said that he lived there and then I tried to narrow it down, broaden it back up a bit

C: So ultimately that one wasn't much use

J: Yeah, it wasn't very useful at all

C: about a person living in the Cooma area

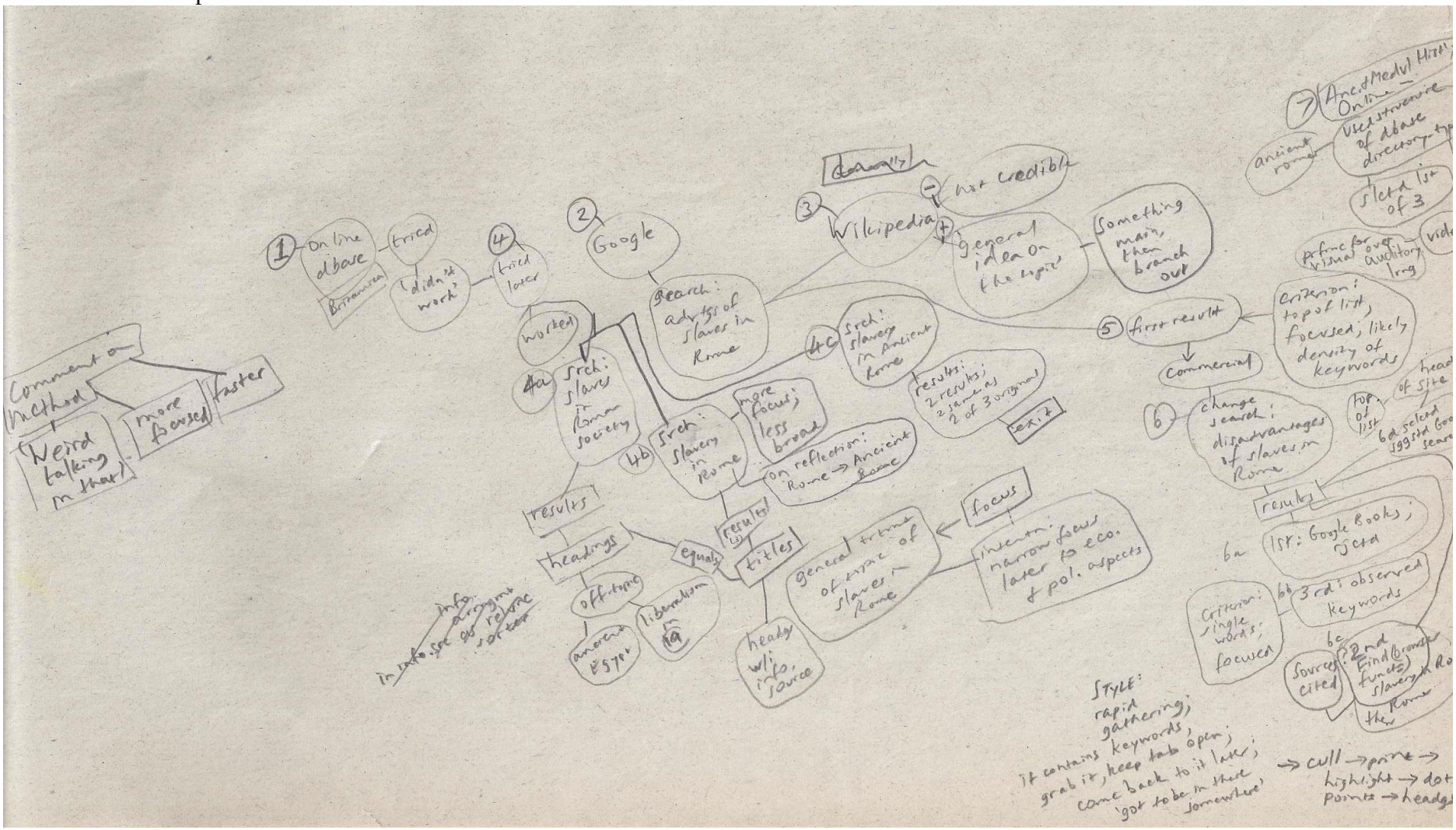
J: And so I tried to broaden it out

C: And you got two

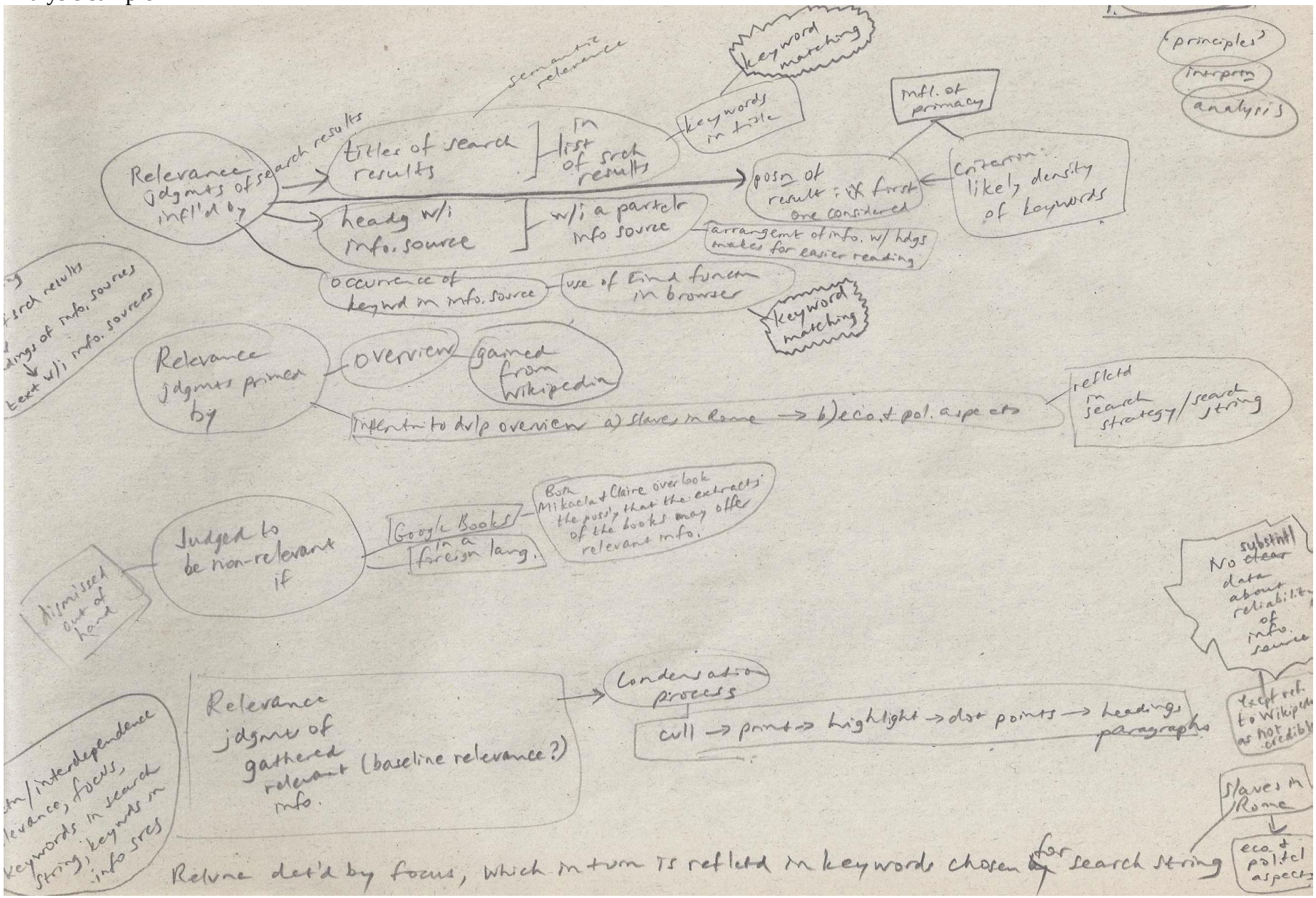
4A

Appendix 3.14: Samples of process sketch and analysis

Process sketch sample



Analysis sample



Appendix 4.1: Nodes used in *NVivo* to categorise relevance

(*Note*: The table below indicates the number of sources categorised in NVivo qualitative data analysis software with the various nodes and sub-nodes of the major category of relevance. The references column indicates the total number of references within and across all sources.)

Nodes	*Sources*	*References*
Relevance	56	638
Chaining	17	54
Backward chaining	1	1
From Wikipedia to Google search	3	3
Search leading to another search	6	11
Wikipedia to other sources	1	1
Wikipedia to Wikipedia links	3	3
Correspondence or corroboration	8	18
Redundancy	2	3
Decreasing relevance beyond first page of results	6	7
Dependence on search engine	8	8
Depth of topic treatment	9	12
Filtering out commercial bias	3	7
First paragraph or sentence	4	6
First result	8	12
Not first result	2	2
Focus	42	130
Condensing	4	7
Focus on particular aspect of topic	30	81
Selection from gathered info	9	9
Structure	12	13
Headings or structure	4	5
Hierarchy of information, understanding of	3	5
Label for relevance	41	105
Negative label for relevance	15	27
Positive label for relevance	38	74
Limited but worth considering	4	7
Matching material to topic	4	5
Gaps in information	1	1

(*Continued on following page*)

Nodes	Sources	References
Metadata clues to relevance	16	31
Snippets	14	24
Title	2	2
URL, relevance	2	4
Proactive relevance	1	2
Structure	1	2
Rejection as irrelevant	13	35
Inclusion as relevant	4	5
Reputation of source, relevance	10	15
Technique for improving relevance	16	38
Topic overview	43	93
Topicality	19	38
Keywords	10	16
Off-topic	4	8
On-topic	6	8
Structure, headings	2	4

Appendix 4.2: Nodes used in *NVivo* to categorise reliability

(*Note*: The table below indicates the number of sources categorised in NVivo qualitative data analysis software with the various nodes and sub-nodes of the major category of reliability. The references column indicates the total number of references within and across all sources.)

Nodes	*Sources*	*References*
Reliability	52	382
Author credentials	20	33
Bias	3	6
Commercial interests	1	1
Comparing information	35	107
Conflicting or contradictory sources	15	19
Corroboration	29	61
Depth of topic treatment	12	24
Derivation	9	10
Design	7	12
Label for reliability	28	55
Negative label for reliability	9	10
Positive label for reliability	22	44
Metadata clues to reliability	12	19
URL, reliability	9	10
Non-binary reliability	4	6
Professional or sophisticated	5	12
Rejection as unreliable	11	15
Teachers' inferred view of Wikipedia	6	7
Reliability of books	5	7
Reputation of resource, reliability	31	59
Source, non-consideration	2	2
Style of writing	6	10
Argumentation	1	2

Appendix 4.3: Socio-academic context (framework matrix)

(*Note*: References from the text to this appendix are in the form of Column.Case; thus, A.4 refers to the column labelled 'A' and the case labelled '4', which in this appendix refers to the participant Lily.)

Case	*A : Socio-academic context*
1 : Jenny Study 1 Year 11 Female	***Reputation of source's reliability based on a generalised personal belief.*** there were *Wikipedia* ones, which aren't necessarily that trustworthy but still good to have a look at them to get a bit of a background (Interview, ll. 25 ff.) *Wikipedia* isn't necessarily reliable (Interview, l. 89) the Internet is full of a lot of bogus sites and things that don't actually connect with fact (Interview, ll. 104-105)
2 : Kathy Study 1 Year 11 Female	***Reputation of source's reliability based on a generalised personal belief.*** it's easier with the books, you know most, you know who the author is but with the Internet, sometimes it's hard to find the author, so you can also look up the author and see where they are coming from, how they did their research for the book (Interview, ll. 140 ff.) I did not use magazines as a source as I believe they are not a reliable source. (Journal, ll. 34-35)
3 : Lara Study 1 Year 11 Female	***No data categorised for this participant***
4 : Lily Study 1 Year 11 Female	***Reputation of source's reliability based on a generalised personal belief.*** sometimes all you get is just that useless stuff on the Internet (Interview, l. 134 ff.)
5 : Maria Study 1 Year 11 Female	***Reputation of source's reliability based on a generalised personal belief.*** Well, it was sort of like, um, like university kind of sites, like the sites, um, looked, well, not looked really reliable but a few of the sites I found had the exact same information on it (Interview, ll. 82-83)
6 : Mia Study 1 Year 11 Female	***No data categorised for this participant***
7 : Vicki Study 1 Year 11 Female	***Topic choice influenced by family member(s), teacher(s) or peer(s).*** my sister was studying genocides at uni, and some of the things she was telling me really got me interested and I was surprised to hear about so many genocides that have happened since, um, kind of behind our backs and that we didn't really know about them (Interview, ll. 16 ff.) ***Topic choice motivated by prior knowledge gained in the context of the curriculum.*** I'm motivated for that because I learned about the Holocaust in Year 10 and I was interested in that but I felt that I didn't really learn as much as I could (Interview, ll. 14 ff.)
8 : Brian Study 1 Year 11 Male	***Reputation of source's reliability based on a generalised personal belief.*** I went to my book shelf and retrieved the "world book encyclopedia" even though it is the 1972 edition it is still ok to use because history doesn't change. And it is probably still more reliable than some websites. (Journal, ll. 46 ff.)

Case	*A : Socio-academic context*
9 : Daniel Study 1 Year 11 Male	***Views in relation to reliability influenced by members of socio-academic community.*** some of the things I did [use *Wikipedia* for] but then I had a look at other sites and then made sure that it was actually relevant and true, yeah, 'cause I've been told in a lot of other subjects not to use it, then I make sure that it's correct, I don't, yeah (Interview, ll. 116 ff.)
10 : David Study 1 Year 11 Male	***No data categorised for this participant***
11 : Kelvin Study 1 Year 11 Male	***Reputation of source's reliability based on a generalised personal belief.*** I think it's mostly good 'cause usually like I said when I use it [*Wikipedia*] I also go to lots of other places that kind of check and don't think I've, apart from when I've seen friends, you know, putting little kind of stupid messages in there, it's been accurate every time I've used it. (Interview, ll. 52 ff.) ***Views in relation to reliability not influenced by members of socio-academic community.*** contrary to what most teachers will have me believe, I find the information to be accurate; as I have not yet found one mistake on wikipedia.(Journal, ll. 35 ff.)
12 : Noah Study 1 Year 11 Male	***Topic choice influenced by family member(s), teacher(s) or peer(s).*** we chose the topic because basically we were just both interested in *Lord of the Rings* and Harry Potter and, I guess, after that we started researching … the similarities between the two (Interview, ll. 21 ff.)
13 : Ryan Study 1 Year 11 Male	***Views in relation to reliability not influenced by members of socio-academic community.*** from past experience it has been pretty reliable, I know you can go into and edit things and there's been stories about government agencies changing things and things like that but ... I think things like seatbelts, I don't think many people want to change the information that much (Interview, ll. 170 ff.)
14 : Amber Study 2 Year 9 Female	***Topic choice influenced by family member(s), teacher(s) or peer(s).*** Um, well, my mum has a lot to do with women's rights and that sort of thing and so I've like grown up with that sort of stuff and that sort of influence I thought it'd be a good topic for me to do (Interview, ll. 26 ff.) ***Reputation of source's reliability based on a generalised personal belief.*** well, books are good, better than the Internet a lot of the time (Interview, l. 406)
15 : Chloe Study 2 Year 9 Female	***Topic choice influenced by family member(s), teacher(s) or peer(s).*** I did do choose a great Australian and I struggled to think of someone so I asked [name of teacher] and he gave me a list of people he thought might be good and then I chose Matthew Flinders off the list (Interview, ll. 38 ff.)
16 : Sophie Study 2 Year 9 Female	***Reputation of source's reliability based on a generalised personal belief.*** if it's on a good website, like ones that I recognise, um, like the Australian government one, I don't, *Wikipedia* is pretty good most of the time as well ... like the encyclopedia websites and stuff like that ... we have *Encyclopaedia Britannica* at home, so I've been on that (Interview, ll. 119 ff.)

Case	*A : Socio-academic context*
17 : Kristian Study 2 Year 9 Male	***Assisted by teacher to make relevance judgements about what to add to or retain in an information product.*** He just went through my introduction and numbered each of the points that he thought I made and then he said each of them should have a separate paragraph so because of the [?four] I grouped them a little bit, like technological advances and the important stuff I put them in the same but he says I should make it separate (Interview, ll. 139 ff.)
18 : Richard Study 2 Year 9 Male	***Reputation of source's reliability based on a generalised personal belief.*** books seem, they seem like they're more, like they actually know what they're talking about because they've got to go through editors, proofreaders, or they should, um, and Internet's just like anyone can put up a page but with a book, generally it's written by, um, people who know what they're talking about (Interview, ll. 258 ff.)
19 : Charlotte Study 2 Year 10 Female	***Reputation of source's reliability based on a generalised personal belief.*** there's going to be a difference between, you know, using something like *Britannica* and, you know, *Wikipedia* is always a bit shifty (Interview, ll. 327 ff.)
20 : Elizabeth Study 2 Year 10 Female	***Reputation of source's reliability based on a generalised personal belief.*** Internet's just annoying cause it's too hard to source in a bibliography, books are better and plus you have to use books anyway [*the assignment mandated the use of books*], so it's better 'cause they mark you down if you don't use books (Interview, ll. 348 ff.)
21 : Emily Study 2 Year 10 Female	***Reputation of source's reliability based on a generalised personal belief.*** sites that were more trust-, trustworthy maybe like, um, there's like the *Britannica Encyclopaedia*, things like that, things that were not somebody's personal webpage but were sort of a company […] a bit more trusted (Interview, ll. 333 ff.) *Wikipedia*, I use a lot, but that's more to find, I don't really use it for specific things because they say that you can change it and it's not really that reliable, so I use it to get an overview of the topic (Interview, ll. 340 ff.) ***Views in relation to reliability influenced by members of socio-academic community.*** they [teachers] said we're not allowed to put it [*Wikipedia*] in our bibliography because it's not a reliable site. I think it's really useful 'cause it has pretty much everything in one spot but, yes, I don't use it for getting specific information for my presentation, just an idea of it (Interview, ll. 429 ff.)
22 : Karen Study 2 Year 10 Female	***Reputation of source's reliability based on a generalised personal belief.*** I: So why do you think books are best? P: Because they have to get a publisher and everything (Interview, ll. 474 ff.) I usually go with the more like, the ones that actually have an author on the page or that are tied back to somewhere like a university or something that looks more reliable (Interview, ll. 517-518.) ***Assisted by member of family to complete task.*** last year I did another Geology assignment and I was looking at Internet pages with my dad, he works at the [name of university] and he got this book for me and it was about earthquakes and it just contained like all the information that I needed (Interview, ll. 425-427)

Case	*A : Socio-academic context*
23 : Rachel Study 2 Year 10 Female	***Reputation of source's reliability based on a generalised personal belief.*** when I actually get information for the speech, like, if there was any statistics or anything I try not to use them from *Wikipedia* 'cause it *is* just like any old bum can write it (Interview, ll. 336 ff.) ***Views in relation to reliability influenced by members of socio-academic community.*** I can't remember quite what it was, but in, I think it was Year 9 [*the year before the one participant was currently in*], I had [*name of teacher*] as a History teacher and he told us, you know, how some websites in dot edu, they're usually good ... dot com means you pay for it, so they're not usually as reliable [but still … *(+3 or 4 words inaudible*)] I know I've a whole list somewhere, and so, yeah, I try and focus on those websites more (Interview, ll. 342 ff.)
24 : Victoria Study 2 Year 10 Female	***Reputation of source's reliability based on a generalised personal belief.*** depending on what they were, I either used the book, the book reference or if it was two websites I'd use the one that I deemed more reliable, whether it was like a government one or something like that (Interview, ll. 286 ff.)
25 : Jake Study 2 Year 10 Male	***Topic choice influenced by family member(s), teacher(s) or peer(s).*** talking with [*name of teacher*] and then we just asked him about racial inequality and then he related it to African Americans to what was happening in Germany at the time (Interview, ll. 51 ff.)
26 : Mark Study 2 Year 10 Male	***Views in relation to reliability influenced by members of socio-academic community.*** just basic facts about it and then I move on to like I guess more reliable sources because *Wikipedia*, like all our teachers have told us that it's sometimes not the best (Interview, ll. 110 ff.)
27 : Michael Study 2 Year 10 Male	***Topic choice influenced by family member(s), teacher(s) or peer(s).*** the reason I chose St Kilda was because personally and my whole family are involved in AFL [Australian Football League], so that made me want to do it because I'm interested in that topic (Interview, ll. 526 ff.) ***Views in relation to reliability influenced by members of socio-academic community.*** I: Did you learn anything of value that you could take to your next piece of research work? P: Yes, don't always go to *Wikipedia*. I tend to just go there anyway, even if I don't write down stuff, I guess, I tend to look if they've got the e- right, they usually are pretty, but you know the teachers always warn you of that, so I'd say *Wikipedia*, and maybe more book work ... It's a harder way to get it but I think it, the results might work out if you take that time and do it I: Right, so you'd avoid *Wikipedia* P: Well, I've been *told* to ... [*interviewer laughs*] by many teachers, so I assume I'm meant to (Interview, ll. 552 ff.)
28 : Chloe Study 3 Year 10 Female	***Reputation of source's reliability based on a generalised personal belief.*** It's a lot harder to post rubbish in books and get them published (Interview, l. 52) 'The fall of Singapore, 60 years ago today' - what am I reading? It's just a blog. (Think-Aloud, l. 150)

Case	*A : Socio-academic context*
29 : Karen Study 3 Year 11 Female	***Views in relation to reliability influenced by members of socio-academic community.*** like my dad always tell me 'Don't believe everything written' (Interview, l. 295-296) ***Reputation of source's reliability based on a generalised personal belief.*** I don't think the History teachers like you to have, like, *Wikipedia* as your reference, kind of thing, so that may be why I'm a bit more biased towards it or something (Interview, ll.453-455) This website's pretty good. And it was quite believable as well, 'cause I had - [?I know] websites are not always believable - but this one had references to, like, Tacitus and all these historians that, I *tended* to believe them, pretty, and they were, like, professors from uni., the author (Think-Aloud, ll. 41 ff.) I guess you can make up if you're a professor, but I thought it sounded like a professor and he had all his references to actual historians and stuff that they sound like they would've been saying ... And it sounded like a really good argument so I thought, 'OK, I'll trust that'. (Interview, ll., 301 ff.)
30 : Lionel Study 3 Year 11 Male	***Evaluated a specific source, rather than relying on a generalised belief about a set of sources.*** P: I would tend to use a *Wikipedia* article, not as the only source but as something you can refer to and you can get a grounding knowledge in, but it's really bad, it's, um, yeah, it's not written well I: For this particular topic P: For this particular page, for the book (Interview, ll. 124, ff.)
31 : Mary-Ann Study 3 Year 11 Female	***Views in relation to reliability influenced by members of socio-academic community.*** I: You've rejected *Wikipedia* P: Because that's like anyone can change it and teachers don't like it if you use it. (Interview, ll. 191-193)
32 : Sharon Study 3 Year 11 Female	***Reputation of source's reliability based on a generalised personal belief.*** 'cause it's not that good a source, 'cause anyone can edit it [*Wikipedia*], but I love to use it as, um, just kind of a starting point for my research. It's a good, not all of it's trusted, but it's a good, um, beginning, it's like, to get my information (Think-Aloud, ll. 17, ff.) Britannica for senior students … I've used this before, it's pretty good website (Think-Aloud, ll. 30-31) Facts on File [*Ancient and Medieval History Online*], used it before, it's very good (Think-Aloud, ll. 48-49)

Case	*A : Socio-academic context*
33 : Sophie Study 3 Year 11 Female	***Reputation of source's reliability based on a generalised personal belief.*** I: Do you remember if you looked at the others [results]? P: Um, not really, to tell the truth. I, that's because *Wikipedia*'s pretty good (Interview, ll. 353, ff.) I: Can you remember on what basis you chose it? P: Aw, I think 'cause it was a lecture, and it's university-level, sounds kind of, um I: You could tell from the blurb P: Yeah I: in the results that it was a lecture P: It said 'Lecture 14' (Interview, ll. 474, ff.) ***Views in relation to reliability influenced by members of socio-academic community.*** I: What is the attitude of teachers to *Wikipedia*? P: Um, I'm not sure. I wouldn't put it on, um, I wouldn't put it on I: in your bibliography P: bibliography, yeah. I don't use it so much as to, like, I guess I use it to get a broad idea but I don't ever use it for, like, the details (Interview, ll. 359, ff.)
34 : Victoria Study 3 Year 11 Female	***Reputation of source's reliability based on a generalised personal belief.*** I have got some stuff from *Wikipedia* but that's not exactly reliable (Interview, ll. 21-22) going to *Encyclopaedia Britannica* 'cause it's a relatively trustworthy source (Think-Aloud, ll. 6-7)
35 : Edward Study 3 Year 11 Male	***Reputation of source's reliability based on a generalised personal belief.*** the first, um, I guess a priority, was to make sure that, you know, it was a doctor's thing, or doctor's website or something along those lines but then, you know, language also does, um, play a significant role. I mean, even if it was written by a doctor or someone along that profession. Now, if it was poorly written, I probably wouldn't bother with them, even, no matter how good the, um, author is (Interview, ll.356, ff.) just another thing about when I'm taking note of the, um, author: normally if they have, like, a, their experience or university degrees or something like that next to their name, it does play a huge role in determining what you are, if you go through with the site or not (Interview, ll.435, ff.)

Case	*A : Socio-academic context*
36 : Gerard Study 3 Year 11 Male	***Reputation of source's reliability based on a generalised personal belief.*** P: So I went back to the other stream and it turned out that was a forum of just people's opinions, so I: And did you reject that? P: Well, yeah, people's opinions on analysis stuff generally aren't very good (Interview, ll.162, ff.) I: So did you, did you copy and paste that into a Word document? P: No, 'cause , um, I think it, because, um, this information was on a news site and it would be within like a more, like academic article somewhere else (Interview, ll. 447, ff.) I roughly scan the page for things that catch the eye and *Geoscience Australia* is a big thing because it's a really, really reliable and it, and it has like a range of sources as well as just like really, um, like in-depth ones as well (Interview, ll.612, ff.) I would've been a lot more satisfied if I could've found like an intellectual article or a journal article. That's why I was searching for A Pascoe's journal article a lot (Interview, ll. 682-683) it's by the ACT Geological Society so they, a lot of, like, people contributing, so it's not very biased but it's got a lot of facts in it [the book], which is good for this, um, I trust it, I do, and they have a very long reference list, which is also nice when you're looking for things; looking through their references is also very good, so I think that's a very trustable source (Interview, ll. 698, ff.) And, yeah, Scholar [*Google Scholar*] gives more, like better opinions on things so if it's in here it'll be better (Think-Aloud, ll. 19-20) *Geoscience Australia* is generally always good (Think-Aloud, l. 92)
37 : Paul 1 Study 3 Year 11 Male	***Reputation of source's reliability based on a generalised personal belief.*** I'm not sure if it is actually his site but it looks more credible than *Wikipedia* since it had an author at the bottom and, you know, some citations (Interview, ll. 45, ff.) they have to get past the publisher, so someone has to actually have read through the content, and given a tick of approval, whereas the Internet, you can publish anything (Interview, ll. 185-187) I'm going to try to get hold of that book and then reference it from that ... 'cause that's even more credible than this, than the site, I have to say (Interview, ll. 240, ff.) I thought, see if I can find a more … credible source and, you know, I recount [*sic*; =recall] having found this site before at some time and thought, well, if it's going to tell me the same stuff about it, as *Wikipedia*, I might as well look to that site because I can actually source it, so I went to that site instead (Interview, ll. 338, ff.) I think when you're doing an assignment, you want some really reliable source, say books are definitely good ... especially, you know, published by universities and stuff (Interview, ll. 384, ff.)

Case	*A : Socio-academic context*
38 : Paul 2 Study 3 Year 11 Male	***Reputation of source's reliability based on a generalised personal belief.*** Whenever you need referencing or quoting […] a source, I usually go for books, 'cause, you know, easily traceable, it's very reliable (Interview, ll. 50-52) generally I go for *Wikipedia*, I think 'cause they're what, I'm just more, I find them much more, they explain things to you much easier than everything else, yeah. But it's really important when you look at these things is that you have some other source of information 'cause some of them could put, you know, some rubbish on *Wikipedia*, and you wouldn't know unless you had some other source and in this case I have all the stimulus material given by the, um, the hosts of the constitutional convention (Interview, ll. 120, ff.)
39 : Stefano Study 3 Year 11 Male	***Views in relation to reliability influenced by members of socio-academic community.*** it just seems to be what everyone's using these days and, teachers actually seem to be quite happy with it, so, it's got a lot of information that I would have otherwise not have been able to get. (Interview, ll. 45-47) I: So how do you know it's legit [*shortened form of 'legitimate' used earlier by participant*]? ... P: More how reliable the source is. Like the encyclopaedias seem to be pretty good, um, random websites, ah, yeah, you don't know what you're getting, so, […] you […] line up with something else, if it seems to be right (Interview, ll. 228, ff.) I: ... where would you put *Wikipedia* on the scale [of reliability]? P: I don't think I could, 'cause you don't know what you're getting, anyone can edit it, but, from what I've heard, I think it's only professors or something that can actually put in permanent stuff there, so, to be honest, I just can't rate it, 'cause you don't know where it's come from ... most of the time it's pretty good and I've never, it's never failed me (Interview, ll. 243, ff.) P: BBC, very, very reliable. Um, one, it's British, they would've recorded it; this was between the Brits and Argentineans, so first-hand perspective and this actually goes through day-to-day what happened ... I: ... the reputation of the BBC as a reliable source of information, is that an opinion you've sort of absorbed from teachers or parents or from personal experience or P: Personal experiences, just, um, SBS, ABC, um, in general, generally would be, um, the best, the best that you can get (Interview, ll. 424, ff.)

Appendix 4.4: Convenience or pragmatism (framework matrix)

Case	*A : Convenient or pragmatic approach*	*B : Pre-access judgement*	*C : Dependence on search engine*	*D : Unconscious or intuitive process*
1 : Jenny Study 1 Year 11 Female	***Considered aspect(s) of research process to be unchallenging.*** Um, generally start by just going with *Google* 'cos it's a pretty easy, um, thing, so, yeah, just type in the names of the things that I'm looking for, like, I was looking for, researching the McCarthy Communist trials in this case, um, so typed that into *Google* and looked at the sites (Interview, ll. 22, ff.)	***Held belief that a particular group of resources was unreliable.*** the Internet is full of a lot of bogus sites and things that don't actually connect with fact (Interview, ll. 104-105)	***No data categorised for this participant***	***No data categorised for this participant***
2 : Kathy Study 1 Year 11 Female	***No data categorised for this participant***	***Decision about access made by school's Internet filtering system.*** Paris Hilton seems to be very popular on the internet and I had to be careful with the sites I used and found that many of them were blocked. (Interview, ll. 33-34)	***No data categorised for this participant***	***No data categorised for this participant***
3 : Lara Study 1 Year 11 Female	***Considered aspect(s) of research process to be unchallenging.*** I owned a copy of *Grease* so that was easy to get a hold of and watch though I do not own a copy of *High School Musical* so I had to track down a copy to watch. I went to Video Ezy and found the movie quickly and easily, though because it was borrowed I could not keep it for as long as I would have liked (Journal, ll. 20, ff.)	***Identified existing knowledge before accessing other sources of information.*** The first thing I did when preparing to write the essay was write down all the facts that I knew about the two movies, including the story lines, the characters, song lists and public opinions. (Journal, ll. 3-5)	***No data categorised for this participant***	***No data categorised for this participant***

Case	*A : Convenient or pragmatic approach*	*B : Pre-access judgement*	*C : Dependence on search engine*	*D : Unconscious or intuitive process*
4 : Lily Study 1 Year 11 Female	***Considered aspect(s) of research process to be unchallenging.*** we used the Internet and, um, just Googled the topic, Harry Potter, and Lord of the Rings (Interview, ll. 10-11) it's pretty like easy to do your own, I guess no one really uses books that much these days 'cause the Internet has so much but then, again, sometimes all you get is just that useless stuff on the Internet, um, so, books, yeah, ah, we couldn't like, I guess we could've asked for help if we wanted it but we were fine by ourselves (Interview, ll.134, ff.)	***Distinguished between tasks calling for the presentation of facts and those calling for the presentation of opinions.*** I guess it's not something that we researched as a definite fact, for what we were researching, so it didn't really have to be … factual. ... it's more opinions and stuff, so we looked at lots, a number of different sites, um, to see all the different like opinions (Interview, ll. 30 ff.)	***No data categorised for this participant***	***No data categorised for this participant***
5 : Maria Study 1 Year 11 Female	***Considered aspect(s) of research process to be unchallenging.*** the topic we're doing is, um, the Bosnian genocide compared to the Holocaust, so we've pretty much just started off looking on *Google* and, um, on the first day we found this website that was pretty disturbing (Interview, ll. 11, ff.)	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant***
6 : Mia Study 1 Year 11 Female	***Considered aspect(s) of research process to be unchallenging.*** I used Google as a search engine as I am the most familiar with it and I find it the easiest to use. (Journal, ll. 25-26)	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant***
7 : Vicki Study 1 Year 11 Female	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant***
8 : Brian Study 1 Year 11 Male	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant***

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
9 : Daniel Study 1 Year 11 Male	***Sought a less challenging path.*** I changed topic because I found researching for my previous topic quite hard and could never find enough relevant recourses [*sic*] to use. ... In my new topic I will be using the example of racism towards Aboriginals, The Holocaust and the American Indians. These topics are much easier to research and find relevant information on. (Journal, ll. 7, ff.)	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant***
10 : David Study 1 Year 11 Male	***No data categorised for this participant***	***Recognised need to distinguish fact from fiction.*** with such a large topic well known topic it was hard to determine fact from fiction (Journal, ll. 29-30)	***No data categorised for this participant***	***No data categorised for this participant***
11 : Kelvin Study 1 Year 11 Male	***Considered aspect(s) of research process to be unchallenging.*** This seemed like a good topic to choose for my History Today essay because of my interest in it, and because of the vast amounts of information there is available on the topic.(Journal, ll. 8, ff.) I find this to be a somewhat effective method for gathering information, as it is usually very easy to do, however, if there is no wikipedia article on a certain topic then it is sometimes hard to find enough information, as a lot of the results given by a google search need close filtering to find any worthwhile information. The reason that I prefer to use wikipedia is because it is so easy to use, and it is usually written in language I can understand. Also, contrary to what most teachers will have me believe, I find the information to be accurate; as I have not yet found one mistake on wikipedia. (Journal, ll. 30, ff.) *(continued overleaf)*	***Held belief that a particular resource was useful.*** The reason that I prefer to use wikipedia is because it is so easy to use, and it is usually written in language I can understand. (Journal, ll. 33 ff.)	***No data categorised for this participant***	***Judged reliability based on visceral reaction.*** P: I guess I'll just go, just kind of try and keep looking to see which one seems to be the more, the result which comes up more or otherwise just whichever I think is, kind of, the most correct ... result or information or whatever you might want to say I: And that's sometimes based on a gut feeling or P: Yeah I: Or based on some other knowledge that you already had

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
11 : Kelvin Study 1 Year 11 Male *(continued from previous page)*	I have finished writing my essay and I did so using only google and wikipedia. This was a very easy way to conduct my research but … it would be nice if there were alternatives (Journal, ll. 52, ff.) ***Sought a less challenging path.*** mostly using my fairly poor research methods of either *Google* searching things I was looking for or looking on *Wikipedia* (Interview, ll. 41-42)			P: Yeah, usually you'll be able to find kind of a lot of things and there'll be one that's common, one that's just kind of, you don't know where it's come from (Interview, ll. 94 ff.)
12 : Noah Study 1 Year 11 Male	***Sought a less challenging path.*** I'd use different research methods for other topics, like, for Contemporary Issues, you just want to get it done with and get a passable sort of mark whereas with History essays or seminars or anything then you, your researching is a bit different and more comprehensive ... and so it would, kind of, I guess, produce skewed results doing it with Contemporary Issues classes. (Interview, ll. 178, ff.) ***Considered aspect(s) of research process to be unchallenging.*** before long we had utilised all that the first 10 Google searches had to offer (Journal, ll. 25-26)	***No data categorised for this participant***	***Used first page in set of results returned by search engine.*** before long we had utilised all that the first 10 Google searches had to offer (Journal, ll. 25-26)	***No data categorised for this participant***

Case	*A : Convenient or pragmatic approach*	*B : Pre-access judgement*	*C : Dependence on search engine*	*D : Unconscious or intuitive process*
13 : Ryan Study 1 Year 11 Male	***Considered aspect(s) of research process to be unchallenging.*** I guess *Wikipedia*'s always good because it's one of the first ones up, it's usually pretty easy to read as, yeah, it's just pretty reliable, I guess, it's always there (Interview, ll. 152, ff.) mainly Internet because it's easy to access and it's just there ready for me (Interview, ll. 200-201) the books are usually pretty, pretty clear-cut to get information out of but they're just, they're probably a bit more effort to access and look through and find information (Interview, ll. 412-414) you have to first find where the books are in the library then you have to find the right book, then you have to go through that book and you find your topic or your area that you're trying to research and you have to get out the details […] but also I guess you can photocopy books but with the Internet page you can just print, it's all there, it's sort of all there waiting for you (Interview, ll. 412-414)	***Used suffixes of URLs to guide reliability judgements.*** Uh, usually they've got a few lines about them and I usually read those and if it's just numbers and dots and lines and things, you assume it's not very good, but if it has sort of the keywords and a sentence that looks … (Interview, ll. 43 ff.)	***No data categorised for this participant***	***No data categorised for this participant***

Case	*A : Convenient or pragmatic approach*	*B : Pre-access judgement*	*C : Dependence on search engine*	*D : Unconscious or intuitive process*
14 : Amber Study 2 Year 9 Female	***Considered aspect(s) of research process to be unchallenging.*** this book was like entirely about it, so it had a lot of information about it, made it easier instead of having to go to lots of different things when I'm looking back at my information (Interview, ll. 302-304)	***Assessed whether information could be understood.*** if it has like a lot of information for starters, like information that I can use and that I can understand. I don't like using information that doesn't make much sense. (Interview, ll. 294 ff.)	***No data categorised for this participant***	***Retrospectively, acknowledged that decision was not made consciously to favour a particular category of resources.*** I didn't plan to use many books, I thought the Internet would be good but once I started looking for information on my topic there wasn't really that much so I, I guess I didn't really decide, I just looked around and then found out that the books were, had more information than the Internet (Interview, ll. 280 ff.)
15 : Chloe Study 2 Year 9 Female	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant***	***Lacked awareness of process that could be articulated for the selection of relevant information.*** Ummm … just sort of r-, I don't really know how I, I just thought things that were relevant. ... nah, I just looked at it and in my su-, brain maybe ... just decided that must be relevant and that's not relevant.(Interview, ll. 154 ff.)

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
16 : Sophie Study 2 Year 9 Female	***Sought a less challenging path.*** I: ... what made you interested in that topic? P: Thought it'd be easy I: Right P: Thought there'd be lots of information on it I: Right, and did that turn out to be the case, or P: Um, there was quite a lot of information but not really the sort of information I wanted (Interview, ll. 28 ff.) ***Considered aspect(s) of research process to be unchallenging.*** ... like a book with, see this one here, *How Gold Shaped Australia*, that's pretty much the question that I'm doing, so there's a whole book with the information that I specifically need. ... And it doesn't have information that I don't need so I don't have to sort through it all (Interview, ll.191 ff.) I think it's pretty easy these days, you can just type it into the computer and stuff will come up (Interview, ll. 385-386)	***No data categorised for this participant***	***No data ategorised for this participant***	***No data categorised for this participant***

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
17 : Kristian Study 2 Year 9 Male	***Sought a less challenging path.*** I looked them all up and figured out which had more information and picked that. (Interview, l. 21) Compared to other assignments I've done, researching, it was less frustrating trying to find information because there was more information available (Interview, ll. 344-345) I found this one website that I was … I went through all these other websites and collected little bits of information and it just kind of frustrated me a bit because then I found this one website that had all of it … it was like a big [*emphasised*] website just about the gold rush and I was kind of upset that I went through all the other ones and gathered little bits when I could've just gone to one but then I suppose I did cross-reference, which is good (Interview, ll. 156 ff.)	***No data categorised for this participant***	***No data categorised for this participant***	***Lacked awareness of process that could be articulated for the selection of relevant information.*** Um, I don't know [*sounding a little awkward at not knowing; slightly embarrassed laugh*], I just decide, um (Interview, ll. 67-68) ***Intuitively applied heuristic for the selection of reliable information.*** [*Having just described a process of corroboration*:] it just happens, I don't really deliberately do it (Interview, l. 181)
18 : Richard Study 2 Year 9 Male	***Considered aspect(s) of research process to be unchallenging.*** firstly I just went to *Google* and just Googled Anzac Day fraud to see if there's anything up and surprisingly there wasn't really anything (Interview, ll. 34 ff.) I thought I'd just check out Anzac Day on *Wikipedia* so I went to *Wikipedia* and I just typed in to the search thing in *Wikipedia* Anzac Day (Interview, ll. 50-51)	***Assessed whether information could be understood.*** if the information that I could find was understan-, if I could understand it, really, if it was very cluttered and a bit over my head, then I sort of went away from that to a more, to information that I could understand (Interview, ll. 245 ff.)	***No data categorised for this participant***	***No data categorised for this participant***

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
19 : Charlotte Study 2 Year 10 Female	***Considered aspect(s) of research process to be unchallenging***. what I think I like about the Internet is there are a lot of links to other things that can help you (Interview, ll. 310-311)	***Held belief that a particular group of resources was reliable.*** So mostly quotations, specific examples, mostly I think I use them [books] for background information and, you know, getting all your facts right (Interview, ll. 304 ff.)	***Used first result in set of results returned by search engine (here, perceived to be a common practice of others).*** I think what most people do is click on the first one. (Interview, l. 105)	***No data categorised for this participant***
20 : Elizabeth Study 2 Year 10 Female	***Applied a rule of thumb to evaluate reliability.*** um, with websites, generally, like it, you wouldn't take information from a MySpace page or anything ... I use like university sites and stuff, like proper History sites, I dunno, Olympics, um, yeah, just things that seem sort of credible, I guess, I dunno [*seemed slightly awkward, embarrassed*] (Interview, ll. 260 ff.)	***No data categorised for this participant, although the participant's use of university sites and 'proper History sites' could be categorised here.***	***No data categorised for this participant***	***Lacked awareness of process that could be articulated for the selection of reliable information, even though able to articulate some heuristics for doing so.*** um, with websites, generally, like it, you wouldn't take information from a MySpace page or anything ... I use like university sites and stuff, like proper History sites, I dunno, Olympics, um, yeah, just things that seem sort of credible, I guess, I dunno [*seemed slightly awkward, embarrassed*] (Interview, ll. 260 ff.)

Case	*A : Convenient or pragmatic approach*	*B : Pre-access judgement*	*C : Dependence on search engine*	*D : Unconscious or intuitive process*
21 : Emily Study 2 Year 10 Female	***Considered aspect(s) of research process to be unchallenging.*** I probably did a bit more research on surrealism, 'cause it was a bit easier to find, there wasn't quite as much stuff on Dada (Interview, ll.139 ff.) Ah, I might've not searched properly but it had pretty much all I wanted, I had a look, I had a flick through it and it looked good (Interview, ll. 230-231) I: So, of all the sources of information that you used, which did you find most useful, if you could pick one or two P: Probably the Internet pages I used, because, um, they were a bit more summarised. With the books, I could find specific information but with the Web pages they had a bit more of a summary, which is easier to read. It took me quite a while to read through the book, which I didn't really have time to, 'cause the presentation was due so, yeah, I really only had time to look through the book, sort of gloss over bits, so and read bits I needed, like, um, how Dada started and I could look into specific details of that but the Internet pages were a little bit more useful (Interview, ll. 266 ff.) I just use *Google* a lot for my searching and I also used *Wikipedia* a lot. I know I'm not supposed to but I always use it to get a summary of the things (Interview, ll. 422 ff.)	***No data categorised for this participant***	***Used first result in set of results returned by search engine.*** I just go into Google and type 'surrealism' and, um, pick the first one that came up and look through that quickly and see if it had, which, it had what I was looking for. (Interview, ll. 302 ff.)	***No data categorised for this participant***

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
22 : Karen Study 2 Year 10 Female	***Sought a less challenging path.*** I: For something like History, then, you prefer not to go to books first P: Yeah, well it's just so much easier to use the Internet (Interview, ll. 129-131) I: So if a book's got just like a chronology ... events listed, if you read through those you find it hard to absorb the information P: Well, I can, but it's just it takes a while to read it all and ... a lot of the time it's like twenty pages or something (Interview, ll. 157 ff.) a lot of the time I've found books contain just, cause they're like, there's a lot more stuff on them, I find them really useful but they're less, like, convenient because you can [?go onto the] Internet and look at four different sources or whatever ... but books you have to go and take the effort but they usually have better ... (Interview, ll. 431 ff.) ***Considered aspect(s) of research process to be unchallenging.*** I just typed in Stalin's war leadership onto *Google* and got a couple of the first sites that came up, I looked at *Wikipedia* a little bit [*short, embarrassed-sounding laughter*], yeah, then I went and got some books and I've been reading one (Interview, ll. 139 ff.)	***No data categorised for this participant***	***Used first result in set of results returned by search engine.*** I just typed in Stalin's war leadership onto *Google* and got a couple of the first sites that came up, I looked at *Wikipedia* a little bit [*short, embarrassed-sounding laughter*], yeah, then I went and got some books and I've been reading one (Interview, ll. 139 ff.)	***No data categorised for this participant***

Case	*A : Convenient or pragmatic approach*	*B : Pre-access judgement*	*C : Dependence on search engine*	*D : Unconscious or intuitive process*
23 : Rachel Study 2 Year 10 Female	***Sought a less challenging path.*** I: So, out of the fifteen, what attracted you mostly to that topic about dropping the bombs on Hiroshima and Nagasaki P: Well, I figured there'd be lots of information on it because it was a very controversial decision ... so I thought that might make it easier (Interview, ll. 36 ff.) P: I found this book in the library [?and because it's] like an old textbook or something and that was really good I: And what made that one good? P: Well, it had, um, 'cause, a lot of these books, they're, like, one historian writing it, and it's just a big thing and sort of get bogged down after a while, but that had, it was cut down into sections and then it had other sources pulled from other History books as well ... separately, to back up ... it was just a lot easier to read because it's more like the text we use in class, rather than the big thing that, I dunno, smart people use [*laughter*] (Interview, ll. 394 ff.) ***Considered aspect(s) of research process to be unchallenging.*** I think I just looked up 'Weimar Germany' or like maybe 'Hitler rise to power' or maybe just like 'Hitler power', I dunno, and they all came up with pretty much the same numbers and so then I went there and it was all on that bit ... it was pretty easy actually (Interview, ll. 519 ff.)	***Assessed whether level of detail suited needs.*** some of them were too detailed and like focusing on other stuff, like, say, just social, and was like massively thick (Interview, ll. 498-499)	***No data categorised for this participant***	***No data categorised for this participant***
24 : Victoria Study 2 Year 10 Female	***Sought a less challenging path.*** I: ... what factors did you use to judge whether a resource was good or bad P: Um [*pause of 6 seconds*] I dunno, it was more, I think, how easily I could get the information I wanted out of the book. If I'd spent ages flicking through it and I didn't find anything, I'd leave it (Interview, ll. 262 ff.)	***No data categorised for this participant***	***No data categorised for this participant***	***No data categorised for this participant, but see Column A.***

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
25 : Jake Study 2 Year 10 Male	***Considered aspect(s) of research process to be unchallenging.*** for the most recent one I didn't do as much as online searching as I usually do ... 'cause there were lots of books I could find (Interview, ll. 263 ff.)	***No data categorised for this participant***	***No data categorised for this participant***	***Initially unaware of process by which topic was chosen but then identified some aspects of the process.*** I: So how did you come to choose that topic? P: Um, I du-, I dunno, I jus-, I dunno, I jus', um, talking with [*name of teacher*] and then we just asked him about racial inequality and then he related it to African Americans to what was happening in Germany at the time (Interview, ll. 49 ff.)
26 : Mark Study 2 Year 10 Male	***Considered aspect(s) of research process to be unchallenging.*** I just went on to the Internet and looked for, um, I just typed into *Google*, 'Why did Japan attack Pearl Harbour?' and it just came up with like these questions and so I just clicked on them (Interview, ll. 56 ff.) It's quicker, it [*Wikipedia*] loads quicker, and ... *Britannica* doesn't have as much information ... Ah, it does but, I don't know, it's just, I find it easier to just go to *Wikipedia* (Interview, ll. 425 ff.)	***Held belief that a particular resource would provide a topic overview.*** it's just like the start of, it's just basic facts about it and then I move on to like I guess more reliable sources because *Wikipedia*, like all our teachers have told us that it's sometimes not the best (Interview, ll. 110 ff.)	***Depended on search engine to provide a resource that offered a topic overview.*** I just click into, say, I always look at *Wikipedia* first cause I know *Wikipedia* is not the best, I always go to other ones, but, yeah, I just get a base knowledge from *Wikipedia* (Interview, ll. 74 ff.)	***No data categorised for this participant***

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
27 : Michael Study 2 Year 10 Male	***Sought a less challenging path.*** [*When asked what, based on what he had experienced in the current task, he would apply to his next task*:] ... don't always go to *Wikipedia* ... and maybe more book work ... it's a harder way to get it but I think it, the results might work out if you take that time and do it (Interview, ll. 554 ff.)	***Identified existing knowledge before accessing other sources of information.*** I'd write my thoughts about it first before what I, the information I get, like, what is my view on it and then I'd start getting the detailed facts like when it happened, why it happened and then the last step is to go into detail (Interview, ll. 108 ff.)	***No data categorised for this participant***	***No data categorised for this participant***
28 : Chloe Study 3 Year 10 Female	***No data categorised for this participant, although the participant's application of a rule of thumb that blogs were not appropriate for her task may be categorised here (see Column B).***	***Held belief that a particular category of resources was suitable or unsuitable.*** books [?generally] give more facts (Interview, l. 56) It's like just a blog sort of thing ... I don't really like blogs. ... No big fan of blogs. ... They seem like, not like official (Interview, ll. 413 ff.)	***No data categorised for this participant***	***No data categorised for this participant***
29 : Karen Study 3 Year 11 Female	***No data categorised for this participant***	***Focused on locating a particular type of resource; here, primary sources.*** [*Interviewer, recalling participant's earlier reference*:] you also said that you wanted to look at the primary sources from the time	***No data categorised for this participant***	***No data categorised for this participant***

Case	*A : Convenient or pragmatic approach*	*B : Pre-access judgement*	*C : Dependence on search engine*	*D : Unconscious or intuitive process*
30 : Lionel Study 3 Year 11 Male	***Sought a less challenging path.*** Yeah, look, this isn't going to be all that easy, so I think I'm just not going to, I'll worry about it later (Think-Aloud, ll. 66-67)	***Noted that payment would be required for full source and thus result was not worth pursuing.*** the problem is … when you do this for books online, they're always sort of 30-word little, like, I dunno, teaser thing that you then have to pay … to get the whole thing, which I'm obviously never going to be doing, which is why *Spark Notes* is actually pretty good 'cause it's free, um, as are *Cliffs Notes*, but I've done all the reading for *Cliffs Notes*. (Think-Aloud, ll. 29 ff.)	***Observed that output of search engine depended on quality of search string.*** Yeah, um, I saw 'relevant quotes' and I thought, 'Well, it might be someone writing [?it]' but, looking back, it was not a great search to put in […] (Interview, ll. 270 ff.)	***No data categorised for this participant***
31 : Mary-Ann Study 3 Year 11 Female	***Sought a less challenging path.*** usually I won't go past the second page 'cause it just gets more and more vague (Interview, ll.115-116) ***Applied a rule of thumb to evaluate potential usefulness***. I'll be using *Google*, 'cause that's sort of just the biggest one (Think-Aloud, l. 5)	***Noted that payment would be required for full source, or would need to be borrowed rather than accessed online, and thus result was not worth pursuing.*** that one was a book you'd have to go and borrow or something or buy (Interview, ll. 176-177) ***Believed that a particular category of resources is worth pursuing for particular information needs.*** what I do like when researching is images, 'cause having all this text and talking about, you know, hot boxes and it's a glass box with wood around the outside, you can't really visualise it. (Interview, ll. 221 ff.) *YouTube* videos and things, they're good as well, 'cause that way you get a sort of visual stuff. (Think-Aloud, ll. 57-58)	***Used first page in set of results returned by search engine.*** Usually I won't go past the second page of a *Google* search 'cause they just get more and more vague as you go along (Think-Aloud, ll. 35-36)	***No data categorised for this participant***

Case	***A : Convenient or pragmatic approach***	***B : Pre-access judgement***	***C : Dependence on search engine***	***D : Unconscious or intuitive process***
32 : Sharon Study 3 Year 11 Female	***No data categorised for this participant***	***Assessed whether information could be understood.*** I didn't really understand what that was saying ... I don't know what language that is. (Interview, ll. 375 ff.) I think I just scrolled, looking for something that was easier to read.(Interview, ll. 384 ff.) I think maybe the headings ... like the, um … 'cause it's got quite, like, it's broken down quite well, how the qu-, with the questions, rather than just like some of the other websites that I went to, it's just like blocks of writing. (Interview, ll. 559 ff.)	***Used first result in set of results returned by search engine.*** I automatically go to the first one 'cause I think that if it's at the top of the list that it must be the most focused on what I've typed in and also like 'cause it came up in, maybe 'cause it came up with the amount of words that it came up with, the amount of mentioning of slavery and stuff that, rather than go to [that one / dark ones], I dunno. (Interview, ll. 274 ff.)	***Lacked awareness of process that could be articulated for the selection of relevant information.*** I: Did you deliberately change it slightly or P: Um, no, I don't think so, I just did it (Interview, ll. 109 ff.) I: Do you remember what your thinking was? P: Um, I dunno, I think maybe because it was, um [*3-s pause*] I dunno (Interview, ll. 437 ff.)
33 : Sophie Study 3 Year 11 Female	***Sought a less challenging path.*** I: ... and *Google*'s your search engine of choice P: Yeah, I don't use any other one, I refuse [*laughter*] Interview, ll. 87 ff.) ***Considered aspect(s) of research process to be unchallenging.*** I probably could've just gone 'history of Pakistan […] *Wikipedia*' but it's pretty easy, *Wikipedia*, you know, you can get, like, links (Interview, ll. 280-281) normally *Wikipedia*'s got a place to go if you want, like, pretty easy-to-find, concise ... (Think-Aloud, ll. 52-53)	***Held belief that a particular resource was useful.*** *Google Books* … I find *Google Books* can be really well, um, really good because, although they don't give you the whole book, they give you tons of books and you can type in, um, the keywords. For instance, I'm doing a History essay on ideology so I can type in 'ideology', um, and see if the word comes up in this book and it'll give me pages, like, so many pages (Think-Aloud, ll. 86, ff.)	***Used first result in set of results returned by search engine.*** It's also the top one so it's easier to click ... with *Google* the first one normally is the one you're looking for (Interview, ll. 80 ff.)	***No data categorised for this participant***

Case	A : Convenient or pragmatic approach	B : Pre-access judgement	C : Dependence on search engine	D : Unconscious or intuitive process
34 : Victoria Study 3 Year 11 Female	***No data categorised for this participant***	***No data categorised for this participant***	***Used first result in set of results returned by search engine.*** I: How did you decide this was the one to go for? P: Um [*3-s pause*], mainly 'cause it was the first one on the top of the list. (Interview, ll. 134 ff.)	***Lacked awareness of process that could be articulated for the selection of relevant information.*** I: What made you think that it was worth including that? What made you decide that was a relevant piece of information? P: Umm … [*3-s pause*] I don' know, I think, [*2-s pause*] I dunno (Interview, ll. 183 ff.)
35 : Edward Study 3 Year 11 Male	***Applied a rule of thumb to evaluate potential usefulness.*** it has the, um, their names highlighted so I can, it's really just an assumption that there's going to be something relating those two [… on that] site (Interview, ll.107-108) So, just Googling 'katherine knight & Martin Bryant' just because [?you get] the most obvious links if you type in the names into *Google*. (Think-Aloud, ll.18-20)	***Held belief that a particular resource was useful.*** mainly *Wikipedia* can be fairly reliable just for some [*moderate emphasis*] facts (Interview, ll. 69-70) ***Held belief that a particular category of resources was suitable or unsuitable.*** this looks like a book website, I'm not exactly interested in that (Think-Aloud, l. 20)	***Depended on metadata provided by search engine.*** I: So what made you go to that first site? P: Well, just because it has the, um, their names highlighted so I can, it's really just an assumption that there's going to be something relating those two [… on that] site (Interview, ll. 105 ff.)	***No data categorised for this participant***

Case	A : Convenient or pragmatic approach	B : Pre-access judgement	C : Dependence on search engine	D : Unconscious or intuitive process
36 : Gerard Study 3 Year 11 Male	***Considered aspect(s) of research process to be challenging (as opposed to the more common 'unchallenging').*** I was looking for the environmental impact statement and I don't really want to pay $25 for it so I guess that's why I'm not finding it easily (Think-Aloud, ll. 67-68)	***Considered opinions to be inappropriate to meet information need.*** P: So I went back to the other stream and it turned out that was a forum of just people's opinions, so I: And did you reject that? P: Well, yeah, people's opinions on analysis stuff generally aren't very good (Interview, ll. 162 ff.)	***Depended on spelling suggestions provided by search engine.*** it took a while trying to spell the Murrumbidgee River … Murrumbidgee Batholith ... Yeah, there's nice spelling suggestions, that's nice of them. (Interview, ll. 529 ff.)	***No data categorised for this participant***
37 : Paul 1 Study 3 Year 11 Male	***Sought a less challenging path.*** P: ... there was a lot of stuff on Beethoven, I was quite sure about that I: OK, so the wide availability of information sources P: Yes, that's the way to put it (Interview, ll. 440 ff.) [*Explaining use of online source, rather than print edition*:] the dictionary's much further away than *Wikipedia* (Interview, l. 260) ***Applied a rule of thumb to evaluate reliability.*** you should by no means use it in an assignment, unless that assignment's not worth anything, which is what I did for my Physics assignment; Physics assignment wasn't worth anything, I thought, OK, just as a practice, I'll pretend *Wikipedia*'s a credible source, but still reference it, but put it under the 'no authors' section (Interview, ll. 346 ff.)	***Assessed whether information could be understood.*** In French, that won't be good (Think-Aloud, l. 31)	***Used first page in set of results returned by search engine.*** I usually don't go on to the second page, unless I'm really trying to find, it's only for games actually, if I really have to find a game, it'll be on the second and third page of a *Google*, but for assignment work, generally on the first page (Interview, ll. 168 ff.)	***No data categorised for this participant***

Case	A : Convenient or pragmatic approach	B : Pre-access judgement	C : Dependence on search engine	D : Unconscious or intuitive process
38 : Paul 2 Study 3 Year 11 Male	***Applied a rule of thumb to evaluate reliability.*** Whenever you need referencing or quoting […] a source, I usually go for books, 'cause, you know, easily traceable, it's very reliable (Interview, ll. 50-52)	***Assessed whether information could be understood.*** I dunno what that means so, I just rejected it (Interview, l. 211) ***Held belief that a particular category of resources was suitable or unsuitable.*** And sometimes if you want to learn, I don't do this often, I've heard of people who've done it, is if they want to learn a subject really quickly, they go on *YouTube*, so for videos how to do that (Interview, ll. 459 ff.)	***Used first and second pages in set of results returned by search engine.*** Unless it's something I know it's going to be difficult to find, in which case I'll go through, you know, up to two pages of *Google* and then stop there ... 'cause anything further it just becomes irrelevant (Interview, ll. 359 ff.)	***No data categorised for this participant***
39 : Stefano Study 3 Year 11 Male	***Applied a rule of thumb to evaluate potential usefulness***. I find it's a bit of a waste of space having it brief 'cause then you could go through the bibliography and […] it does take time (Interview, ll. 278-279) ***Considered aspect(s) of research process to be unchallenging.*** I can skip straight past it and if it perha-, perchance it does have something that's useful, that I'm missing out on, I can always go back and get it, it's not really a big deal (Interview, ll. 281-283)	***Held belief that a particular category of resources was suitable or unsuitable.*** sometimes the stuff I use, um, isn't really, I can't really go to videos 'cause it's not recorded stuff. [In] hindsight, I probably should go to videos because this would've been a recorded, this was a recorded incident ... that happened not so long ago (Interview, ll. 125 ff.) generally I just tend to skip videos and go [?with what's] just written down. ... Um, it's just harder to analyse and, if I'm doing an assignment, I just want what's basic, given to me in plain English, I don't have to go searching for in extreme depth (Interview, ll. 135 ff.)	***Used first result, and first page, in set of results returned by search engine.*** I: You've got Falklands War, and I see you go to the first one. Can you walk me through what decided you to take that first one? P: Ah, it's just first instinct really. It's what I always generally do, you just put in your topic and see what comes up. (Interview, ll. 33 ff.) I: Would you generally use the first result? P: Um, no, not at all. It just, perchance, it was the first one so I went into it ... if I can't find anything, then I'll just move past. I generally don't go past the first page of *Google* 'cause it tends to lose, um, what you're looking for [?down the …] so why bother going to the next page? (Interview, ll. 73 ff.)	***Applied habitual information search habit.*** just going to go natural instinct and go straight for *Google* (Think-Aloud, l. 13)

Appendix 4.5: Relevance priming (framework matrix)

Case	A : Relevance priming
1 : Jenny Study 1 Year 11 Female	***Used* Wikipedia *article to gain an overview of topic***. there were *Wikipedia* ones, which aren't necessarily that trustworthy but still good to have a look at them to get a bit of a background (Interview, ll. 25 ff.) *Wikipedia* isn't necessarily reliable so, um, that one I just go to for a general overview of what happened, not for names or dates or anything set in stone really (Interview, ll. 89 ff.)
2 : Kathy Study 1 Year 11 Female	***Used prior knowledge as basis of information search.*** I re-discovered information I had on Marilyn Monroe and I used this as my starting point. (Journal, ll. 13-14)
3 : Lara Study 1 Year 11 Female	***No data categorised for this participant***
4 : Lily Study 1 Year 11 Female	***No data categorised for this participant***
5 : Maria Study 1 Year 11 Female	***Gained an overview of the topic, using a non*-Wikipedia *source***. the topic we're doing is, um, the Bosnian genocide compared to the Holocaust, so we've pretty much just started off looking on Google and, um, on the first day we found this website that was pretty disturbing … like it had pictures and stories it had pictures of victims of the Bosnian genocide (Interview, ll. 11 ff.) ***Used prior knowledge as basis of information search.*** Well, the Holocaust, we mainly learned about in Year 10 History because you do sort of like German history there and I'm doing, um, German history at the moment which involves like the Holocaust and everything but, um, I hadn't actually heard of the Bosnian genocide before because I was away when they chose topics and everything. (Interview, ll. 32 ff.)
6 : Mia Study 1 Year 11 Female	***Gained an overview of the topic, using a non*-Wikipedia *source.*** decided to research online sources on the witch trials in order to grasp a better basic understanding of the trials before reading the book in detail- so as to understand the circumstances on a whole before going into detail about them (as the book does). (Journal, ll. 22 ff.)
7 : Vicki Study 1 Year 11 Female	***No data categorised for this participant***

Case	A : Relevance priming
8 : Brian Study 1 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** for every topic, the first thing I do would be type it in Google and then go to the *Wikipedia* page and that would give me an overview of what it's all about and then, I suppose, if I'm looking for something specific, I go back to Google and search for that (Interview, ll. 33 ff.)
9 : Daniel Study 1 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** In most searches that I do I find a Wikipedia page as one of the first choices. They are not the most reliable pages although do provide a lot of data so I use them as a reference and than back up the information with further research. (Journal, ll. 52 ff.)
10 : David Study 1 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** Wikipedia gave me good background information about both the topics. Wikipedia gave me a basis to my comparative argument, as well as links to other relevant sites. Information from Wikipedia was used to assist the my searching on google. (Journal, ll. 14 ff.)
11 : Kelvin Study 1 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** As with most research, I find the easiest and most effective way to do this to be reading the wikipedia articles on the subjects. After I have done this I will google search the subjects in order to test the accuracy of the information on wikipedia. If all the information I find proves to be accurate then I will continue reading the various web pages found in the google search in order to learn as much as possible about the ipod and walkman. I find this to be a somewhat effective method for gathering information, as it is usually very easy to do, however, if there is no wikipedia article on a certain topic then it is sometimes hard to find enough information, as a lot of the results given by a google search need close filtering to find any worthwhile information. The reason that I prefer to use wikipedia is because it is so easy to use, and it is usually written in language I can understand. Also, contrary to what most teachers will have me believe, I find the information to be accurate; as I have not yet found one mistake on wikipedia. (Journal, ll. 23 ff.)
12 : Noah Study 1 Year 11 Male	***Used* Google *to find information that would provide introductory material (unclear if* Wikipedia *formed part of that).*** I went straight onto Google to get some basic information. (Journal, ll. 7-8)
13 : Ryan Study 1 Year 11 Male	***No data categorised for this participant***
14 : Amber Study 2 Year 9 Female	***Used a book to obtain an overview of topic.*** that one was really good because it has information in general on everything but also it has like specific sort of case studies of particular women in history that were influential in the establishment of the colony (Interview, ll. 269 ff.)
15 : Chloe Study 2 Year 9 Female	***No data categorised for this participant***
16 : Sophie Study 2 Year 9 Female	***Used a book to obtain an overview of topic.*** most of them are for like primary school aged students, the ones that you can find on the gold rush, like especially in the library and this library at school ... but they're not bad ... they've got basic information (Interview, ll. 173 ff.)

Case	A : Relevance priming
17 : Kristian Study 2 Year 9 Male	***Attracted to a source that provided a broad treatment of topic. Noted advantage of corroboration of information sources gathered independently.*** I found this one website that I was … I went through all these other websites and collected little bits of information and it just kind of frustrated me a bit because then I found this one website that had all of it … it was like a big [*emphasised*] website just about the gold rush and I was kind of upset that I went through all the other ones and gathered little bits when I could've just gone to one but then I suppose I did cross-reference, which is good (Interview, ll. 156 ff.)
18 : Richard Study 2 Year 9 Male	***Used* Wikipedia *article to gain an overview of topic; Wikipedia article became basis of relevance chaining.*** and so I decided I'll just research what really Anzac Day is all about and the Gallipoli campaign so went to *Wikipedia*, had a look through there to the external links and where they got their, what they referenced (Interview, ll. 39 ff.)
19 : Charlotte Study 2 Year 10 Female	***Sought an introduction to topic (unclear if* Wikipedia *played a part) in a* Google *search.*** I would start with the kind of background [?so I don't start half] completely clueless, do a little research on that and then get into the more specifics that concern my topic question ... I had to get a bit of background information on, um, Germany, England, 1930s, Berlin in the 1930s, so I just typed in, you know, Germany 1930s or Berlin 1930s (Interview, ll. 66 ff.)
20 : Elizabeth Study 2 Year 10 Female	***Attracted to a source that provided a broad treatment of topic.*** in the article like it had all the controversial issues so I could draw the comparisons and made it more interesting so the people listening to it could like draw out more moral dilemmas and stuff (Interview, ll. 142 ff.)
21 : Emily Study 2 Year 10 Female	***Used* Wikipedia *article to gain an overview of topic.*** *Wikipedia*, I use a lot, but that's more to find, I don't really use it for specific things because they say that you can change it and it's not really that reliable, so I use it to get an overview of the topic and then I go into Google and search for whichever bit I'm interested in (Interview, ll. 340 ff.)
22 : Karen Study 2 Year 10 Female	***Used* Wikipedia *article to gain an overview of topic.*** I just typed in Stalin's war leadership onto Google and got a couple of the first sites that came up, I looked at *Wikipedia* a little bit [*short, embarrassed-sounding laughter*], yeah, then I went and got some books and I've been reading one and ... I find it harder to like, because there's so much more information in a book, so, and I find it easier to get a general overview first and understand it all than to go read [a book]. (Interview, ll. 139 ff.)
23 : Rachel Study 2 Year 10 Female	***Used* Wikipedia *article to gain an overview of topic.*** I looked it up on *Wikipedia*, read through that and then looked up some books and read three ... I didn't really take any notes, and other websites and stuff ... just to see like what happened and really understand it, so I'd know like what information to look for (Interview, ll. 79 ff.)
24 : Victoria Study 2 Year 10 Female	***Used a book (print encyclopedia) to obtain an overview of topic.*** I usually, if it's a nice topic, I'll look at the encyclopedia and get a starting point or I'll look something up on the Internet and then when I've got details, I'll look more into those ... and expand through that [...] to different sources (Interview, ll. 43 ff.)

Case	A : Relevance priming
25 : Jake Study 2 Year 10 Male	***Attracted to a source that provided a broad treatment of topic.*** I: ... what would make one more useful to you than another? P: I guess how in depth it went into the treatment of the different races and just like how broad it was, like how good it was at painting a picture of the whole, sort of, scenario, what was going on I: So, would you, were you looking for broad treatments of the topic? P: Yeah, I was sort of [looking] for broad things so it could give me different clues and I could go try, if I did something, if I liked something that I'd found and it wasn't fully explained, I could go on the Internet and that would broaden what I'd found out (Interview, ll. 334 ff.)
26 : Mark Study 2 Year 10 Male	***Used* Wikipedia *article to gain an overview of topic.*** I always look at *Wikipedia* first 'cause I know *Wikipedia* is not the best, I always go to other ones, but, yeah, I just get a base knowledge from *Wikipedia* ... Yeah it's just like the start of, it's just basic facts about it and then I move on to like I guess more reliable sources because *Wikipedia*, like all our teachers have told us that it's sometimes not the best (Interview, ll. 74 ff.)
27 : Michael Study 2 Year 10 Male	***Used prior knowledge as basis of information search.*** I'd just get some notes down in my book, I'd write the topic, the question, and then I'd write my thoughts about it first before what I, the information I get, like, what is my view on it and then I'd start getting the detailed facts like when it happened, why it happened and then the last step is to go into detail ... but first the basic things should be done (Interview, ll. 107 ff.)
28 : Chloe Study 3 Year 10 Female	***Used* Wikipedia *article to gain an overview of topic.*** I generally start with Wiki, just if I don't know, just to give me a general idea 'n' 'cause it could be wrong 'cause Wiki's pretty, could be, anyone can write stuff on Wiki ... so I just start with Wiki, 'cause like a lot of this stuff is correct, like they do this stuff in little boxes down the side, it's quite correct, like not *quite* correct but sort of correct, so I start with that and gives you like, say, date, location, and quite clearly, and stuff, so if I need of [?] that sort of stuff, Wiki does that, and then just have a quick scan through the contents and then I'll go, and then I'll just have a quick read of it and then I'll go to the other sites and stuff. (Interview, ll. 65 ff.)
29 : Karen Study 3 Year 11 Female	***No data categorised for this participant***
30 : Lionel Study 3 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** I would tend to use a *Wikipedia* article, not as the only source but as something you can refer to and you can get a grounding knowledge in (Interview, ll. 124 ff.)
31 : Mary-Ann Study 3 Year 11 Female	***Gained an overview of the topic, using a non*-Wikipedia *source.*** if you're just starting off, then, um, then you'll just look for some key information ... at the start I'll like get a brief overview, so like I'll get the basics down, and I'll get all the basics and then I'll go back over a bit (Interview, ll. 51 ff.) usually I just go for the basics first, so I'll get a basic outline of what I'm trying to find out and then I'll just build on it after a few researching sessions (Interview, ll. 19 ff.)

Case	A : Relevance priming
32 : Sharon Study 3 Year 11 Female	***Used* Wikipedia *article to gain an overview of topic.*** sometimes I go into *Wikipedia* to, like, get a general overview of the topic (Think-Aloud. ll. 16-17)
33 : Sophie Study 3 Year 11 Female	***Used* Wikipedia *article to gain an overview of topic.*** *Wikipedia*'s always a good place to start ... I guess I use it to get a broad idea but I don't ever use it for, like, the details (Interview, ll. 65 ff.)
34 : Victoria Study 3 Year 11 Female	***Used* Wikipedia *article to gain an overview of topic.*** Um, that came from, well, first I looked it up on *Wikipedia* 'cause that's, although not reliable, usually it gives you pretty good general idea of what to look for, so I got quite a lot there (Interview, ll. 82 ff.)
35 : Edward Study 3 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** mainly *Wikipedia* can be fairly reliable just for some [*moderate emphasis*] facts but, you know, it is [*emphasised*], usually just to, main- it's just a starting reference point for me; other than that, I'll normally just go to the, take the information from that, double-check it with, um, newspapers and independent articles that have been written (Interview, ll. 69 ff.)
36 : Gerard Study 3 Year 11 Male	***Gained an overview of the topic, using a non*-Wikipedia *source.*** Yeah, and so went into that and tried to find some news sites because they generally sum it up pretty well (Interview, ll. 426 ff.)
37 : Paul 1 Study 3 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** *Wikipedia*'s useful in terms of, um, concepts or topics which you have absolutely no idea, you just need a brief introduction to it, you should by no means use it in an assignment, unless that assignment's not worth anything (Interview, ll. 345 ff.) So, I'm going to choose Beethoven because I know something about him, but not much, so we'll first learn about Beethoven from *Wikipedia*. (Interview, ll. 13 ff.)
38 : Paul 2 Study 3 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** I do it for some assessment items but only use a little bit. For example, if we did a History article, I didn't know what so-and-so was, the first place I'd go to was, would be, *Wikipedia*, and learn about that ... and then once I had an idea what the general topic would be I then research into other sites (Interview, ll. 74 ff.) Using *Wikipedia* to get an idea of what […] is, I'm not actually referencing any of this. (Think-Aloud, ll. 16-17)
39 : Stefano Study 3 Year 11 Male	***Used* Wikipedia *article to gain an overview of topic.*** Just done *Wikipedia*, the lead-up to the conflict, which is essentially what were the causes, and I'm going to my second website, um, just here, History of the Falklands Dispute [naval-history.net]. (Think-Aloud, ll. 43 ff.)

Appendix 4.6: Relevance chaining (framework matrix)

Case	A : Relevance chaining
1 : Jenny Study 1 Year 11 Female	***Connection made with prior knowledge.*** we studied it in American Literature in English so that's why I knew a bit about it (Interview, ll. 34-35)
2 : Kathy Study 1 Year 11 Female	***Connection made with prior knowledge.*** I think I decided that topic, I don't know, we were just talking and thought it would be interesting, I suppose, and I'd done some research, research on Marilyn Monroe before, for an English oral and, um, I enjoyed that and I think she's an interesting person, so I wanted to compare her to someone else and that's what came to mind. (Interview, ll. 17 ff.) Found out I knew more about Marilyn Monroe than Paris Hilton, this is most likely because I had previously done research on Marilyn Monroe. (Journal, ll. 6 ff.)
3 : Lara Study 1 Year 11 Female	***Connection made with prior knowledge.*** The first thing I did when preparing to write the essay was write down all the facts that I knew about the two movies, including the story lines, the characters, song lists and public opinions. Though because I did not know a great deal about all of these facts I knew that I would have to do some research about the movies before writing my essay. (Journal, ll. 3 ff.)
4 : Lily Study 1 Year 11 Female	***Connection made with prior knowledge. Used prior knowledge to test reliability.*** most of them were, because we were comparing with the similarities between Harry Potter and Lord of the Rings and most of them were all, you know, actual facts because we've both read and seen the movies of both of those so we actually knew that they were correct (Interview, ll. 72 ff.)
5 : Maria Study 1 Year 11 Female	***Connection made with prior knowledge.*** Well, the Holocaust, we mainly learned about in Year 10 History because you do sort of like German history there and I'm doing, um, German history at the moment which involves like the Holocaust and everything (Interview, ll. 32 ff.)
6 : Mia Study 1 Year 11 Female	***No data categorised for this participant***
7 : Vicki Study 1 Year 11 Female	***No data categorised for this participant***
8 : Brian Study 1 Year 11 Male	***Used citation in one source to explore topic further.*** Went to wikipedia, then checked date on a second website in reference list at the bottom of the wikipedia article. (Journal, ll. 42-43)
9 : Daniel Study 1 Year 11 Male	***Connection made with prior knowledge.*** I chose it mainly because I was doing that sort of thing in History at the moment, Australian History, with the Aboriginals and I just thought it would be interesting to … yeah (Interview, ll. 26 ff.)

Case	A : Relevance chaining
10 : David Study 1 Year 11 Male	***Used information found in one source to search for information in other sources.*** Information from Wikipedia was used to assist the my searching on google. (Journal, ll. 16-17) ***Connection made with prior knowledge.*** I had also heard of Australia's war on the waterfront, which was well known when it happened and the united workers, stopped it. (Journal, ll. 8 ff.)
11 : Kelvin Study 1 Year 11 Male	***Connection made with prior knowledge.*** just kind of things I've heard on the news about, you know, all the kind of copyright problems with the iPod and then of course with your Walkman there was kind of all the tapes and things that happened with that and that just kind of I dunno you see a lot of stuff about it and when you kind of looking to buy one, you look into it and see what kind of things there are (Interview, ll. 118 ff.)
12 : Noah Study 1 Year 11 Male	***Used prior knowledge to test reliability.*** a lot of them of them you can kind of just tell because you can generally, with a bit of background information, you just know whether they sound feasible or not (Interview, ll. 39-40)
13 : Ryan Study 1 Year 11 Male	***No data categorised for this participant***
14 : Amber Study 2 Year 9 Female	***No data categorised for this participant***
15 : Chloe Study 2 Year 9 Female	***Searched for sources in order to give coherence to prior knowledge.*** I: Before you started, did you have some of your own ideas about what makes a great Australian? P: I had, like, in my head I thought thoughts but I couldn't put them into words so I went to the Internet, like, what I though a great Australian was came out in words on the Internet for me (Interview, ll. 143 ff.)
16 : Sophie Study 2 Year 9 Female	***Acknowledged role of multiple sources, and extending knowledge beyond immediate needs of task.*** I read a lot of stuff, I just kept reading, like the books, I read through the whole book ... and so I knew quite a lot, even if I knew I couldn't use it, I knew it, so it was ... easier (Interview, ll. 256 ff.)
17 : Kristian Study 2 Year 9 Male	***Acknowledged role of multiple sources.*** I found, like, three or so websites and I copy and pasted a lot of the information onto a big Word document ... I went through all these other websites and collected little bits of information (Interview, ll. 156 ff.)
18 : Richard Study 2 Year 9 Male	***Used citation in one source to explore topic further.*** so I decided I'll just research what really Anzac Day is all about and the Gallipoli campaign so went to *Wikipedia*, had a look through there to the external links and where they got their, what they referenced ... I went to a few of them and they were more or less good reference points, a few of them from the War Memorial ... and I thought that those were the best sort of ones because they're from the government and they're a bit more established than *Wikipedia* (Interview, ll. 39 ff.)

Case	A : Relevance chaining
19 : Charlotte Study 2 Year 10 Female	***Used information found in one source to search for information in other sources.*** I usually type in like keywords of the question, like, you know, Motown, or I, I'd prob-, what I did first was type in dream girls, so, um, get the inspiration for it, and it came from the group The Supremes who were a female trio of the 1960s, African American, then I looked at, um, them, and the kind of, and then I'm going to start looking at the socio-economic state of the US at the time as well (Interview, ll. 83 ff.) what I think I like about the Internet is there are a lot of links to other things that can help you. (Interview, ll. 310-311)
20 : Elizabeth Study 2 Year 10 Female	***No data categorised for this participant***
21 : Emily Study 2 Year 10 Female	***Connection made with prior knowledge.*** We do, we learn a bit about different Art movements so I already have a bit of background knowledge in some of them, which helps me look for certain artists I like or things like that (Interview, ll. 34 ff.) ***Used information found in one source to search for information in other sources.*** *Wikipedia*, I use a lot, but that's more to find, I don't really use it for specific things because they say that you can change it and it's not really that reliable, so I use it to get an overview of the topic and then I go into *Google* and search for whichever bit I'm interested in (Interview, ll. 340 ff.)
22 : Karen Study 2 Year 10 Female	***Connection made with prior knowledge.*** I was interested in Russia and, um, like, just how he dealt with the war and stuff because like in the seminars and stuff people were talking about how like, compared to Germany, especially with the [?planes] at the start of the war, they were really unorganised and, um, a lot of the planes got shot down, so I was just wondering why, what made them worse than Germany, Russia, well that they got better (Interview, ll. 33 ff.)
23 : Rachel Study 2 Year 10 Female	***Unable to make connection with prior knowledge.*** the Cold War topics, I didn't want to do any of them even if they had information because we hadn't done anything in class on that (Interview, ll. 49-50)
24 : Victoria Study 2 Year 10 Female	***Connection made with prior knowledge.*** I looked at the topics that were there and I'd just done a History presentation on Roosevelt and I was just interested to know the precise reasons behind the actual dropping of the bomb (Interview, ll. 27 ff.) ***Acknowledged role of multiple sources, and extending knowledge beyond immediate needs of task.*** I got quite a lot of books with piles of information in them and so I just stuck it all in and then I had to go through and get rid of it all cause it didn't fit or I didn't like that actually (Interview, ll. 135 ff.) I think my problem is I enjoy reading the books so I'll sit there and keep reading, whether the information is relevant or not (Interview, ll. 328-329)
25 : Jake Study 2 Year 10 Male	***Used information found in one source to search for information in other sourc*** if I liked something that I'd found and it wasn't fully explained, I could go on the Internet and that would broaden what I'd found out (Interview, ll. 343 ff.)
26 : Mark Study 2 Year 10 Male	***Connection made with prior knowledge.*** I watched, like, last year with my dad, like this whole like series on the bodyline. It was like seven episodes of like half an hour, it was real boring, but … I like cricket so it was just like, yeah, I've got some basic knowledge on it (Interview, ll. 189 ff.)

Case	A : Relevance chaining
27 : Michael Study 2 Year 10 Male	***Connection made with prior knowledge.*** with the Nagasaki one, obviously it's a massive, you know, thing that happened in history and it was the first use of the atomic bomb and I was just interested to, how, you know, I already had some insight into it. I'd rather choose a topic that I know a bit about than something I don't know about (Interview, ll. 64 ff.) with the Nagasaki question I found that the most interesting one compared to the rest, cause I actually had a little bit of knowledge and wanted to learn more (Interview, ll. 546 ff.)
28 : Chloe Study 3 Year 10 Female	***Connection made with prior knowledge.*** just reading on, um, most of, knew most of that, knew most of that, Invasion of Malaya - not really interested in that; um, Preparations - got most of that; Japanese Landings - had most of that; um, The Second Day - got most of that; The Japanese Breakthrough - got most of that; Alexandra Hospital Massacre - sad, very sad - got that; Fall of Singapore - I've got a lot on that (Think-Aloud, ll. 47 ff.)
29 : Karen Study 3 Year 11 Female	***Used information found in one source to search for information in other sources.*** I've done a tiny bit of research - and it is that Romans became dependent on their slaves through, slaves did pretty much all jobs in society and, yeah, so, like I think thirty per cent of people were slaves, so, yeah, I'm just going to look it up (Think-Aloud, ll. 10 ff.)
30 : Lionel Study 3 Year 11 Male	***Serendipitously found information linked to topic.*** I actually ended up finding something but it was a review and analysis, so it wasn't what I was expecting but I read it, and it said a couple of things that were actually quite important […] It wasn't what I was looking for but I read it and there was a couple of, like, it was short and there were a couple of good things in there. It was someone who obviously thinks it's one of the best films ever made, um (Interview, ll. 209 ff.)
31 : Mary-Ann Study 3 Year 11 Female	***Used information found in one source to search for information in other sources.*** Once you have a good site, sometimes you'll take a piece of information from it, and search it from that, so like the physicist, so maybe I'll search him from that first site that gave me the information on him. ... What I'd next do is just have a read through, see what else I can find and then search from that new information (Think-Aloud, ll. 61 ff.)
32 : Sharon Study 3 Year 11 Female	***Examined information and found a lack of connection with topic (non-chaining).*** They weren't, yeah, I was, I said that they weren't, they were a bit too off-topic for me, talking about ancient Egypt, I didn't really need that. ... Liberalism in nineteenth century just doesn't really seem anything to do with what I wanted. (Interview, ll. 122 ff.)
33 : Sophie Study 3 Year 11 Female	***Connection made with prior knowledge and information found to be redundant.*** I didn't really think it was very useful ... it was just people being like […] it was like, 'Ah, I don't know, it may be put in the short list', that sort of thing. I thought, um, you know, it was, like, things I already knew, like its structure and stuff. (Interview, ll. 212 ff.)
34 : Victoria Study 3 Year 11 Female	***Connection made with prior knowledge.*** I: So how did you know that bit of information? Where did that come from? P: Um, that came from, well, first I looked it up on *Wikipedia* 'cause that's, although not reliable, usually it gives you pretty good general idea of what to look for, so I got quite a lot there. (Interview, ll. 82 ff.)

Case	A : Relevance chaining
35 : Edward Study 3 Year 11 Male	***Used information found in one source to search for information in other sources.*** when I was searching through the *Sydney Morning Herald*, it came up with, you know, as a child he showed erratic behaviour; now, from prior knowledge, the, many of these things can lead to mental illnesses so if I type in 'erratic behavior leads to?' it leaves the, um, it leaves it open to, you know, people trying to answer the question and narrow it down even further so […] the third link down is 'What is erratic behaviour?', Yahoo Answers so if I was to click on that link, I'm fairly sure to get, you know, what it leads to, what is it and what it means (Interview, ll. 298 ff.)
36 : Gerard Study 3 Year 11 Male	***Used information found in one source to search for information in other sources.*** This is where I was trying to figure out […] the EIS, the environmental impact statement, so I was trying to find that online because I saw that referred to in the, um, […] minutes of the meeting ... [later:] And I saw 'silurian', which jogged my memory that I was looking at the Silurian volcanics so I thought I might as well try to broaden that even more into a bit more specific like geological terms. (Interview, ll. 312 ff.) ***Used citation in one source to explore topic further.*** it's by the ACT Geological Society so they a lot of like people contributing so it's not very biased bit it's got a lot of facts in it, which is good for this, um, I trust it, I do, and they have a very long reference list, which is also nice when you're looking for things; looking through their references is also very good, so I think that's a very trustable source. (Interview, ll. 698 ff.)
37 : Paul 1 Study 3 Year 11 Male	***Connection made with prior knowledge.*** at some point here he mentions Franz Liszt, another really good composer I happen to, well, just like one of his amazing songs, the Hungarian Rhapsody No. 2, so I'm like, ah, OK, there's a correlation between the two, and Franz Schubert, which I also play for, which I played for seventh grade, and I thought, OK, there's another correlation between Franz Schubert and he also is, um, a great fan of Beethoven [?so, all right,] there's a link there (Interview, ll. 309 ff.)
38 : Paul 2 Study 3 Year 11 Male	***Used information found in one source to search for information in other sources.*** I wanted to find some things on how to behave in parliament because they mentioned at some stage you really need to be very formal and I was not aware of anything like that (Interview, ll. 241 ff.) ***Used citation in one source to explore topic further.*** occasionally I look at the links at the bottom of the *Wikipedia* page ... they have the citing, citations ... and that's quite good. (Interview, ll. 85 ff.)
39 : Stefano Study 3 Year 11 Male	***Acknowledged role of multiple sources, and extending knowledge beyond immediate needs of task.*** I try and get as many different things on, like, er, say bits of information, put them together, see what's relevant, see what's not relevant, so I can get, it's more of a genuine […] just get a lot of different information on the same topics so I can pick out what may not be true, what is true, because I don't know anything about this, so I've got to find legitimate […] (Interview, ll. 166 ff.)

Appendix 4.7: Building knowledge (framework matrix)

Case	A: Filtering	B: Matching	C: Adding
1 : Jenny Study 1 Year 11 Female	***Filtered out information considered to be too narrow in focus.*** because my mum works at the university, she helps me find a few online journals and stuff ... so I looked at, I tried to look at a few but I find them a little bit challenging sometimes because they're mainly written for a specific purpose, like they are like specifically to answer one set question that isn't really giving a very broad range of information so I didn't find that quite as helpful but it does give you bit of a deeper perspective (Interview, ll. 42 ff.)	***Compared information from several sources in order to establish which was reliable.*** Um, generally the things that come up in more than one place are the ones that appear reliable. ... for the things that you need to, er, like, for the things, to find out like important things, you just look for the things that have been repeated through a wide variety of sources, like if you find something in a book that is also on an Internet site it's a pretty good chance that it's true (Interview, ll. 88 ff.)	***No data categorised for this participant***
2 : Kathy Study 1 Year 11 Female	***Printed books as a group of sources excluded from consideration on the basis that they were unlikely to contain information on chosen topic area.*** you don't get many books on Paris Hilton, so I used internet (Interview, l. 38)	***Corroborated information using other sources and depended on most prevalent information.*** I compared some of the Internet ones, um, like some had, different, um, pieces of information to others so I went with whatever they had the most of, like. (Interview, ll. 88-89)	***Sorted information into categories.*** I split the essay up into, I think I had three, um, paragraphs, and one would've focused on their childhood and the other on how they dealt with fame and then the, how they're similar 'n' their differences and that parallel kind of thing and then, um, sort of sorted my information into those three categories. (Interview, ll. 235 ff.)

Case	A: Filtering	B: Matching	C: Adding
3 : Lara Study 1 Year 11 Female	***Challenged by filtering of Internet information.*** I was reluctant to go onto the internet to look for information since there I often find more information than I want and it is hard to pick out the needed information. For this reason I used the information that I had gathered from watching the movies and my prior knowledge to write the essay. (Interview, ll. 32 ff.)	***No data categorised for this participant***	***Interacted with information sources for different purpose on successive occasions.*** I watched each of the movies once to get a general idea of what the movie was like, I then watched each movie a second time and while watching it a second time I took notes on the storylines and the characters in the movies so that I could compare them afterwards (Journal, ll. 29 ff.)
4 : Lily Study 1 Year 11 Female	***Filtered out particular type of website (chat rooms) on the basis of their perceived unreliability.*** the chat rooms were unreliable ... like because they just, they're more people's opinions about the actual movies but the other sites because they were like official Harry Potter websites or, um, actually intelligent people talking about, um, you know, like, say, book or movie reviewers actually saying intelligent things about both the movies, it's not just, you know, your average whoever gets on the Net saying 'I think this' (Interview, ll. 96 ff.)	***Compared information in found source with prior knowledge (in this case, personal opinions).*** I guess just compare them with what we think to see if they're actually kind of reliable, like, um, you know if it says that we didn't agree with then like that's not a valid opinion that we really want so it's only the opinions of people who made like valid suggestions and comments that we really kind of took into account (Interview, ll. 53 ff.)	***No data categorised for this participant***

Case	A: Filtering	B: Matching	C: Adding
5 : Maria Study 1 Year 11 Female	***No data categorised for this participant***	***Compared several sources and found agreement among them.*** we read over lots of websites but a lot of the websites had the same information on it. I think the exact same (Interview, ll. 50 ff.)	***No data categorised for this participant***
6 : Mia Study 1 Year 11 Female	***No data categorised for this participant***	***Compared information in found source with prior knowledge.*** During the course of researching on the internet I discovered the connection between Arthur Miller's play *The Crucible* written in 1953 and the events that occurred during the Salem witch trials in 1692. (Journal, ll. 36 ff.)	***No data categorised for this participant***
7 : Vicki Study 1 Year 11 Female	***Used search results appearing first or at beginning of list.*** It's more the ones that I think will be relevant, um, mainly the ones at the top and I read the little paragraph underneath and think whether it's going to be relevant or not (Interview, ll. 74-75)	***Compared information in found source with prior knowledge.*** *and* ***Compared information from several sources in order to establish which was reliable.*** I'll write it all down and then I'll double-check it with, maybe a book, or another Internet website, or just on my knowledge so […] I'll always double-check it to make sure it's right (Interview, ll. 84 ff.)	***Paraphrased information from sources.*** Except for the definitions but then, yeah, most of it is straight into my own words (Interview, l. 102)

Case	A: Filtering	B: Matching	C: Adding
8 : Brian Study 1 Year 11 Male	***Searched for specific piece of information on found website.*** if it's not too big, I just scroll down, reading most of it, 'cause usually there's something else that I pick up that I didn't think of before, but if it's a big page, I'll just use, um, the finder that's built into the browser to find the word I was looking for or the phrase (Interview, ll. 88 ff.)	***Compared information from several sources in order to establish which was reliable.*** I look for the page author and if it's something like a date or something that really common, I'll be able to go and search it again and maybe find it on another page and that'll affirm that that's the correct date (Interview, ll. 100 ff.)	***Paraphrased information from sources from memory.*** I mainly just have it in my head, and then I'm thinking about as I go. Ah, sometimes I write notes if it's really interesting although the really interesting things I probably remember more anyway. ... I prefer to do that because otherwise I end up, because if I, if I'm writing the notes while I'm looking at it, I end up just writing exactly the same thing and by relying on my memory I kind of rewrite it in my words. (Interview, ll. 126 ff.)
9 : Daniel Study 1 Year 11 Male	***Searched for information that would suit current level of personal knowledge and that would provide more general information on topic.*** Somehow, by maybe looking at new, um, new websites that, inc-, that don't have, um, as complicated explanations of it or something like that so I can just define it down to a simpler essay maybe 'cause a lot of the time I will repeat stuff too much and then it'll make the word limit go over and if I read over it again, I realise that I can cut a lot of stuff out without actually messing it up but, yeah (Interview, ll. 370 ff.)	***Compared information from several sources in order to establish which was reliable.*** I used a lot of Internet sources and I do use a lot, like *Wikipedia* and stuff, but then I back it up with, um, there's a lot of the things on there can be edited, so I back that up with another website after, just to make sure. (Interview, ll. 69 ff.)	***Structured information for presentation purposes.*** I just put the conclu-, the introduction in, I normally put that in after, did the bodies first and then made that after and then I just outlined what I was going to do in that, like made a little introductory line and then outlined what I was going to put in it and then, at the start of every paragraph, I have, um, a line that just outlines what's going to be in that, and then at the end of it, I have a concluding line that'll link in with the next body of the essay. (Interview, ll. 191 ff.)

Case	A: Filtering	B: Matching	C: Adding
10 : David Study 1 Year 11 Male	***No data categorised for this participant***	***Compared information from several sources in order to establish which was reliable.*** I compared this information to the basic information I had got from the Wikipedia site. (Journal, ll. 22-23)	***Sorted information into categories.*** I used the information I gathered from the sources and placed them in to the categories and then I looked to find information on the categories which I needed more then I started to write the essay. (Journal, ll. 31 ff.) While writing the essay I to break it up in to the common categories which I had pre defined while I was breaking it up into categories. I then wrote the essay. After writing the draft I looked back at my information to check whether the source of the information is factual. (Journal, ll. 36 ff.)
11 : Kelvin Study 1 Year 11 Male	***Reduced use of* Wikipedia *in response to perceived objections to it from teachers.*** most teachers appear to not like it [*Wikipedia*] too much, so I try and use it less. (Interview, l. 59)	***Corroborated information using other sources and depended on most prevalent information.*** if it's just kind of a value I think will just kind of, if it says, you know, the speed of sound or something I'll look at *Wikipedia* and then I'll just kind of put that into *Google* and see what it says and just see if the two, see if kind of across a couple of sites, if all the values match. ... I'll just go, just kind of try and keep looking to see which one seems to be the more, the result which comes up more or otherwise just whichever I think is … the most correct. (Interview, ll. 77 ff.)	***Paraphrased information from sources.*** And then just kind of reading as much information as I could doing that and just kind of trying to learn things then write it out in my own words from that stuff I've learned. (Interview, ll. 46 ff.)

Case	A: Filtering	B: Matching	C: Adding
12 : Noah Study 1 Year 11 Male	***Paid particular attention to information that suited personal focus.*** to convey the similarities between Harry Potter and *Lord of the Rings* and sort of discuss the hype surrounding them and the different, um, types of hype, I guess, sort of different type of audiences et cetera (Interview, ll. 131 ff.)	***Compared information in found source with prior knowledge.*** [*Asked how he decided opinions were reasonable or valid*:] a lot of them of them you can kind of just tell because you can generally, with a bit of background information, you just know whether they sound feasible or not (Interview, ll. 39-40)	***No data categorised for this participant***
13 : Ryan Study 1 Year 11 Male	***Filtered out websites perceived to lack relevance or reliability, based on snippets and URLs.*** usually they've got a few lines about them and I usually read those and if it's just numbers and dots and lines and things, you assume it's not very good, but if it has sort of the keywords and a sentence that looks … (Interview, ll. 43 ff.)	***No data categorised for this participant***	***Took notes when information considered relevant.*** And then I'd go and get it and then sit down and highlight the things that are worth keeping, like maybe I can just rewrite them out later into the speech or just, yeah, just keep a highlighter, just read through the paper (Interview, ll. 190 ff.)
14 : Amber Study 2 Year 9 Female	***Excluded information that did not suit personal focus.*** some of the information was a bit silly, it was sort of just, you know, like saying that women came out to Australia just to like make dresses and that sort of stuff so that sort of stuff I think it was a bit pointless ... that sort of information I just get rid of straight away (Interview, ll. 313 ff.)	***Compared sources and found that some were more detailed than others.*** there were sources that were more detailed and more helpful (Interview, l. 333)	***Wrote down information that may be relevant to essay in order to remember it.*** like I read it and then I like went to like think of what I wanted to put in my essay and I couldn't really remember the sort of stuff that was in the book, so I wrote it down so that I could remember it and wrote it down just to get notes down what was important in the book and what pages so that I could go back to them (Interview, ll. 133 ff.)

Case	A: Filtering	B: Matching	C: Adding
15 : Chloe Study 2 Year 9 Female	***Found that one source provided only an introduction but that another source, found subsequently, provided more detail.*** in the book, the book I found at the National Library, they went on about how he went to Tahiti first then he went back to England, then he went back to Australia, then he did Tom Thumb voyages then he did, um, second, then he did a circumnavigation of Tasmania, then went back to England and came back and did the Australian navigation rather than saying he did it all in one go (Interview, ll. 316 ff.)	***Corroborated information using other sources and depended on most prevalent information.*** So, if three books, if there was one 1800 verse [*sic*] 1801, if another book had 1801, or another two books had 1801, I went with the 1801 books because more books and different authors had 1801 compared to one book that had 1800 (Interview, ll. 375 ff.)	***Used a table to sort most relevant information from related, but less relevant, information.*** I drew up a table of like important and not relevant and just wrote all the information down in like dot points of what the book said (Interview, ll. 55 ff.)
16 : Sophie Study 2 Year 9 Female	***Filtered out websites as a source type and focused on books, which turned out to be a more profitable source type.*** this time I just decided to go get books and ... they had the most information in them (Interview, ll. 164-165)	***Found information contradictory, and so put it aside and consulted other sources.*** I think I just, I stopped reading them and went onto a different site (Interview, l. 217)	***Added points of interest to a Word document.*** if there were points that interested me, I put them on a Word document (Interview, l. 64)

Case	A: Filtering	B: Matching	C: Adding
17 : Kristian Study 2 Year 9 Male	***Used suffixes of URLs to guide reliability judgements.*** there was just so much and it was a dot gov site ... so that usually does mean that it is reliable (Interview, ll. 205 ff.)	***Compared information in found source with prior knowledge.*** I found this one website that I was … I went through all these other websites and collected little bits of information and it just kind of frustrated me a bit because then I found this one website that had all of it … it was like a big [*emphasised*] website just about the gold rush and I was kind of upset that I went through all the other ones and gathered little bits when I could've just gone to one but then I suppose I did cross-reference, which is good (Interview, ll. 156 ff.) ***Compared information from several sources in order to establish which was reliable.*** like I realise it's on two websites but then I usually seem to be more comfortable with writing [all/more?] about that because I believe it more (Interview, ll. 189-190)	***Sorted information into categories.*** When I was looking at the information I got on the Web, there was, I could kind of tell that there was lots of stuff about immigration and that was obviously social and economic and then there were things about how much money it brought and imports and things like that and I just kind of, I had a chart where I was like economic, social, cultural, and I read through to the highlighted bits and put it somewhere and if there was a new kind of topic I'd add it in (Interview, ll. 89 ff.)

Case	A: Filtering	B: Matching	C: Adding
18 : Richard Study 2 Year 9 Male	***Discriminated between sophisticated and unsophisticated website design.*** there were a few like when you just Googled and went Anzac Day and go to one, they look a bit, they don't look like there's much design put into them ... so I look at them and I think, well, that's probably not the best one to choose so I go to one that looks more like it's had some detail and effort put into it (Interview, ll. 79 ff.)	***Compared several sources and found agreement among them.*** Um, surprisingly I found that most of the sources I found were in a very neutral standpoint but there were a few that basically were trying to convince me that Anzac Day is to remember that and that we all fought brilliantly, which is sort of the conclusion I've drawn with my essay (Interview, ll. 193 ff.)	***Sorted information into categories.*** I put it into a bit of a fact sheet so what I've got is I've got a Word document opened up and I put in what happened on Anzac Day, er, then I put a few dot points um the day of that then I went like um what happened at Gallipoli campaign and then put some dot points about that and then effects of it (Interview, ll. 102 ff.)
19 : Charlotte Study 2 Year 10 Female	***Discriminated between sophisticated and unsophisticated website design.*** [*When asked about how she told the difference between a sophisticated and an unsophisticated website*:] Well, the layout first of all ... also how you can tell you if it's sophisticated, you get little things popping up saying, oh, you know, 'Press the joke button' blah blah blah (Interview, ll. 353 ff.)	***Corroborated information using other sources and depended on most prevalent information.*** [*When asked about how she dealt with contradictory information*:] You look at more and see what's the majority. (Interview, l. 372)	***Added important points to a Word document.*** as I go through I write down important points in my book or in a Word document and I'll print that off and use it later (Interview, ll. 146-147)

Case	A: Filtering	B: Matching	C: Adding
20 : Elizabeth Study 2 Year 10 Female	***Filtered out websites as a source type and focused on books, which treated topic more thoroughly.*** Well, the Olympics, the websites, there wasn't really that much information but the books, I dunno, they just went through it more thoroughly. (Interview, ll. 218-219) ***Rejected websites whose names did not sound professional.*** I don't know what it is, like it has something in the name that makes it sound more professional. (Interview, ll. 278-279)	***Compared several sources and found agreement among them.*** [*When asked whether she had noted any variance in views expressed about the 1936 Olympic Games or the Beijing Games*:] well, none of them actually said that people shouldn't have gone or anything (Interview, l. 298)	***The choice of a good, relevant and interesting topic led to success in the assignment, leading to personal and peer engagement in a culmination of the building of knowledge.*** [*When asked to identify factors contributing to the success of her assignment*:] I chose a good question ... 'cause it was really relevant, so it was more interesting, 'cause some people just did really boring things, they shouldn't get good marks cause no-one was interested. (Interview, ll. 320 ff.)
21 : Emily Study 2 Year 10 Female	***No data categorised for this participant***	***Corroborated information using other sources and depended on most prevalent information.*** I think there might've been a few where they had the wrong dates or something and, um, so if I found something that had different information to what I was doing, I'd, um, look up a lot of other sites, I'd like specifically look for that information and see which ones had the most of one sort of date and didn't have a lot of the other ones so I'd use that to tell if it was the right one and also find sites that were more trust-, trustworthy maybe like, um, there's like the *Britannica Encyclopaedia* [*sic*], things like that, things that were not somebody's personal webpage but were sort of a company […] a bit more trusted (Interview, ll. 329 ff.)	***No data categorised for this participant***

Case	A: Filtering	B: Matching	C: Adding
22 : Karen Study 2 Year 10 Female	***Broadened or narrowed search if retrieved results were not sufficiently relevant.*** I, usually, if there's not very much stuff that I find, I usually change it to go more, less broad (Interview, ll. 406-407)	***Corroborated information using other sources and depended on most prevalent information.*** if Internet pages, see a lot of them have this similar things I think, well, they're probably all right, because, yeah, I dunno (Interview, ll. 463-464)	***Took notes when information considered relevant; moved to another website if not considered relevant.*** I sometimes take pretty detailed notes but that's only when I'm on to the note-taking [*inaudible*], a lot of the time I just read it and then go OK I need to take notes on this or I don't I'll go and find another website (Interview, ll. 181 ff.)
23 : Rachel Study 2 Year 10 Female	***Used suffixes of URLs to guide reliability judgements.*** I can't remember quite what it was, but in, I think it was Year 9 [*the year before the one participant was currently in*], I had [*name of teacher*] as a History teacher and he told us, you know, how some websites in dot edu, they're usually good ... dot com means you pay for it, so they're not usually as reliable [but still … (*+3 or 4 words inaudible*)] I know I've a whole list somewhere, and so, yeah, I try and focus on those websites more (Interview, ll. 342 ff.)	***Compared information from several sources in order to establish which was reliable.*** if like they say this many people died on *Wikipedia*, I want to check that with other sources ... I usually check [*pause*] with textbooks and stuff, 'cause they're usually pretty good as well, to have the whole overview and then just like books and other websites to get more of an overview of what happened and see if it matches up 'cause some things are [*1w inaudible*] (Interview, ll. 367 ff.)	***Took notes in form of bulleted points; copied, pasted and paraphrased information from sources considered relevant and interesting.*** I'd take like dot points and stuff off websites and books and whatever ...of what I think might be relevant or interesting ... I just like copy and paste from websites and then I actually change it into my own words when I write the essay but I just get that 'cause it's easier and I'm not actually gonna need to put it in my own words until I actually write the thing (Interview, ll. 97 ff.)

Case	A: Filtering	B: Matching	C: Adding
24 : Victoria Study 2 Year 10 Female	***Discriminated between a source providing an outline in the form of main points and one providing a more detailed treatment of her topic.*** The outlines were … it gave me the main points that I needed and I could go to the other book and see the specific points that I wanted, so details of the Tenancy Act, or whatever it was (Interview, ll. 235 ff.) ***Used suffixes of URLs to guide reliability judgements.*** if it was two websites I'd use the one that I deemed more reliable, whether it was like a government one or something like that (Interview, ll. 287 ff.)	***No data categorised for this participant***	***No data categorised for this participant***
25 : Jake Study 2 Year 10 Male	***Sorted information according to focus intended to demonstrate in final product.*** include or not include different parts of information that support what I'm trying to say (Interview, ll. 244-245)	***Matched gathered information with other sources in order to identify gaps.*** I went and found some books and started there and once I wrote down all the information I got from there and then I sort of went home and then if there're any gaps then I'd look it up on the Internet and then check it with another site (Interview, l. 81)	***Took notes from sources considered topical and of significance.*** I guess I would just write down anything that I felt related to the topic that I was doing and was actually something that I needed to write down and would remember, like a big point (Interview, ll. 141-142)

Case	A: Filtering	B: Matching	C: Adding
26 : Mark Study 2 Year 10 Male	***Used first sentence of paragraph or introductory paragraph to establish relevance.*** Um, I just read the introduction paragraph about what they said and then like, if they're on the right track, then I go on with that but if they're not, I just close it and go to another one (Interview, ll. 134 ff.)	***No data categorised for this participant***	***Paraphrased information from sources from memory.*** After that, after I've looked at all the pages, um, I read them all again, read everything all again so it's in my head, sort of, and then I just start off answering the questions in the essay. (Interview, ll. 146 ff.)
27 : Michael Study 2 Year 10 Male	***Filtered irrelevant results to find relevant results.*** like you don't need all that, all that stuff (Interview, l. 158)	***Corroborated information using other sources and depended on most prevalent information.*** I'd have to obviously look at the, check that, make sure it's a proper site and I'd look not only amongst one, you'd have to look amongst others to see if it's generally the same group of numbers and if one of them's just completely different, [?the obvious number, *or* you obviously know], that should be it (Interview, ll. 500 ff.)	***Took notes when information considered relevant.*** I usually open up a Word document and do the facts in there ... then source it, or I just do it in my book, write down the notes, where I got it from and keep it, keep it in case I need it for later on. ... You need to, er, you can't just copy and paste the whole thing, you need to analyse which parts you need of it and which is actually relevant to the topic and without, using your own words as well. (Interview, ll. 138 ff.)
28 : Chloe Study 3 Year 10 Female	***Ignored information on one topic because she was looking for information on another topic.*** just quick scan-reading, 'cause I'm not doing the Battle of Malay, and I've got a lot on preparations, don't really need to know about Japanese landing, that sort of stuff, so I just went through it (Interview, ll. 126 ff.)	***Compared information in found source with prior knowledge.*** the Allied have twenty-two thousand killed, 5000 wounded and 50,000 captured - pretty rounded numbers but I got them more accurate from books (Think-Aloud, ll. 42 ff.)	***No data categorised for this participant***

Case	A: Filtering	B: Matching	C: Adding
29 : Karen Study 3 Year 11 Female	***Discriminated between sophisticated and unsophisticated website design.*** I think if it's too showy and has like too many advertisements, like, I'd kind of stay away, wouldn't stay away, but I won't ... I'd be like this probably isn't as like dependable as like a boring one ... because it's got ads and an overload of pictures, I think, 'OK, this probably won't contain much information'. (Interview, ll. 370 ff.) ***Considered source reliable on basis of writing style.*** it sounded like a really good argument ... his way of writing, like he actually sounded intelligent, not just like, and the depth that he went into just, say, had a whole lot of pictures and then like, I dunno, slavery was good, or, you know, he actually had evidence 'n' discussed it in depth and stuff (Interview, ll. 333 ff.)	***Compared several sources and found a lack of agreement among them.*** on this website I was looking at, um, some historians seem to, there's very conflicting views, some seem to, in that times, thought they were treated well but others thought they were treated really badly so I guess I want to get lots of, um, primary sources from the time. This website [*the one from which Karen appeared to be recalling material from while writing notes in a Word document*] showed lots of, ah, the richeast org one, showed lots of, it had contrasting views (Think-Aloud, ll. 17 ff.)	***No data categorised for this participant***

Case	A: Filtering	B: Matching	C: Adding
30 : Lionel Study 3 Year 11 Male	***Filtered irrelevant results to find relevant results.*** Orson Welles the trial, um, script [*search: orson welles the trial script*] U-u-u-m, that's not right, that's a bit strange [*skim-through of the first page of results doesn't yield any results that promise the script of the film*], um, *The Trial*, 1962, sometimes they do years (Think-Aloud, ll. 58 ff.) these are all kind of off-topic quotes (Think-Aloud, l. 169)	***Compared information in found source with prior knowledge.*** John K, well, it's Joseph in the book but anyway I didn't realise his name was John in this (Think-Aloud, l. 107)	***Noted information that related to a focus chosen by the student and deemed it worth using.*** That's interesting, 'Franz Kafka, Czech novelist, short story writer, The Advocate, in *The Trial*, chapter 8, an echo of, um, … that's quite interesting, I'm going to use that, because I talk in my final section, which is the sort of the existential section, about how existentialists stress the importance of absolute freedom of choice of the individual to find their own meaning in life. (Think-Aloud, ll. 188 ff.)
31 : Mary-Ann Study 3 Year 11 Female	***Filtered out websites on the basis of their perceived unreliability.*** So I'm not going to pick one from *Wikipedia* or from *Fox News* or something 'cause they just don't sound like they're going to be decent, reliable, scientific sites (Think-Aloud, ll. 27 ff.)	***Compared several sources and found agreement among them.*** when you search, and, you sort of … when all the websites sort of add on to each other and they all say basically the same thing, so you go to a whole bunch of different websites, you may go to five or six, like, then there won't really be any new information, like major new information, um, there'll just be little bits that, you know, you didn't know that you can just add into it afterwards (Interview, ll. 87 ff.)	***Paraphrased information from sources.*** it's much easier to put it in your own words as you go along rather than do it at the end (Interview, ll. 63-64) I'll pick apart some important bits of information and read through and try and put it in my own words (Think-Aloud, ll. 16-17)
32 : Sharon Study 3 Year 11 Female	***Used search results appearing first or at beginning of list.*** I guess I jus' go into the first one that comes up if it's there, and I went into it and it was something like you had to buy it or something (Interview, ll. 294 ff.)	***No data categorised for this participant***	***Perceived an area in which more detailed information needed to be added.*** I need to look more up on the … economic and political influence (Think-Aloud, ll. 56-57)

Case	A: Filtering	B: Matching	C: Adding
33 : Sophie Study 3 Year 11 Female	***Used search results appearing first or at beginning of list.*** with *Google* the first one normally is the one you're looking for (Interview, ll. 84-85)	***Compared information in found source with prior knowledge.*** I heard somewhere that he had attended Princeton, which is where, I think maybe it was, anyway, and I was looking in here, it said he attended college but then I actually [?knew it was] Princeton so I wrote it down here, so I can check that later (Interview, ll. 97 ff.)	***Copied and pasted information from sources considered relevant and interesting.*** OK, modern-day Pakistan 1999-2007 [*hyperlinked heading and subheading in* Wikipedia *article*] OK, 2000 … The US, um. After the US-led invasion, Pakistan … highlight and paste this, probably. I like to paste things and then I can go through them later when I've got, like, all the information in front of me (Think-Aloud, ll. 53 ff.) ***Sorted information into categories.*** I'll put it under subheadings, like, um, Soviets, um, evidence suggesting were not aggressive and expansionist and, um, then, um, the US, were the aggressors, um, responsible for tensions and I just need to find things now, I put them under these subheadings (Think-Aloud, ll. 74 ff.)
34 : Victoria Study 3 Year 11 Female	***Used first sentence of paragraph or introductory paragraph to establish relevance.*** sort of scan-reading like the first sentence of each sort of paragraph and if it was, appeared that it would be helpful, I continued reading the paragraph and stuff (Interview, ll. 63-64)	***Compared information in found source with prior knowledge.*** same stuff I've read in books and *Wikipedia* ... something I've already got (Think-Aloud, ll. 8 ff.)	***No data categorised for this participant***

Case	A: Filtering	B: Matching	C: Adding
35 : Edward Study 3 Year 11 Male	***Filtered out websites perceived to lack reliability, based on authorship and writing style.*** the first, um, I guess a priority, was to make sure that, you know, it was a doctor's thing, or doctor's website or something along those lines but then, you know, language also does, um, play a significant role. I mean, even if it was written by a doctor or someone along that profession. Now, if it was poorly written, I probably wouldn't bother with them, even, no matter how good the, um, author is (Interview, ll. 353 ff.)	***Compared information in found source with prior knowledge.*** the information is definitely, it was correct ... based on prior knowledge, um, from other reading, going through legal documents, um *Austlii*, which is another […] gives you the case, so, you know, I've compared it to there, you know, um, previously, so I've [?got] an understanding if it's correct or if it isn't (Interview, ll. 185 ff.) ***Compared information from several sources in order to establish which was reliable.*** I'll normally just go to the, take the information from that, double-check it with, um, newspapers and independent articles that have been written (Interview, ll. 71 ff.)	***Took notes when information considered relevant.*** I made notes mentally and I'm starting to formulate a point for the final question in this case study, which is, you know, how it's related to Bryant, so Martin Bryant and, um, to an extent, Ivan Milat (Interview, ll. 240 ff.)
36 : Gerard Study 3 Year 11 Male	***Filtered irrelevant results to find relevant results.*** I rejected all of them because they were talking about some place in Tanzania. ... after this, I typed in the same thing except minus Africa [<-africa>]. (Interview, ll. 80 ff.)	***Compared information in found source with prior knowledge.*** I had a bit of read down to see if there was anything else that might be interesting or useful in there and then the Colinton volcanics came up again and that again jogged my memory to try and search for the Colinton volcanics and the Silurian volcanics. (Interview, ll. 598 ff.)	***Took notes when information considered relevant (negative example).*** […] so I highlighted that. I was going to open a Word document but I realised it wasn't really worth that ... because it's just trying to, um, sustainable development kind of goals (Interview, ll. 330 ff.)

Case	A: Filtering	B: Matching	C: Adding
37 : Paul 1 Study 3 Year 11 Male	***Filtered irrelevant results to find relevant results.*** His family stuff, probably not necessary (Think-Aloud, l. 77)	***Compared information in found source with prior knowledge.*** also it seemed to have some relevant information because when I did, um, music theory for my seventh grade, it has some, you know, background information about where he grew up and it seemed to match with the stuff on the site (Interview, ll. 185 ff.)	***Paraphrased information from sources from memory***. Most of it's from memory 'cause I've read the information quite well and I cite it and it just helps to not plagiarise things when you put it more into your words [?and you say] you got this idea from this site […] (Interview, ll. 97 ff.)
38 : Paul 2 Study 3 Year 11 Male	***Searched for information that would suit current level of personal knowledge and that would provide more general information on topic.*** I found that some of the other sites, um, usually explain in, you know, quite some depth with assumed knowledge and that's not for me.(Interview, ll. 181 ff.)	***Compared information in found source with prior knowledge.*** And the slight problem here was that, um, the *Wikipedia* article said it's the same thing [a plebsicite is the same thing] as a referendum ... but, to my knowledge, currently, it isn't. (Interview, ll. 304 ff.)	***Identified area in which knowledge was added and assessed current level of understanding.*** the rest of time was spent just learning about this [Australia's constitutional crisis in 1975], what the double dissolution is, which I still don't quite get.(Interview, ll. 408-409)
39 : Stefano Study 3 Year 11 Male	***Excluded on basis of perceived lack of effort in creating information.*** The one with brief information didn't seem like it had a lot of effort put into it, it's just one or two sentences; everything else is more advertising, other parts of the site, I see that and say 'Oh, well, someone has obviously not put very much effort into it, so it mustn't be a fantastic overview' (Interview, ll. 302 ff.)	***Compared information in found source with prior knowledge.*** I've got other information, I've got other websites, so generally the information tends to line up, it seems to be pretty good, so I just basically go off that and I also sometimes have books.(Interview, ll. 53 ff.)	***Identified general pattern of knowledge building, indicating role of prior knowledge.*** I don't tend to learn a lot the first time I go through an assignment. It's more the second or third time when I go back and read fully over things and spend a bit more time on it. (Interview, ll. 342 ff.)

Appendix 4.8: Positive references to relevance

Amber, Interview, Study 2 • really good	*Jake, Interview, Study 2* • related to the topic • needed
Charlotte, *Interview, Study 2* • relevant • important points	*Karen, Interview, Study 2* • important • I know I want to use it in my essay
Chloe, Interview, Study 2 • important • good things	*Karen, Think-Aloud, Study 3* • This website's pretty good. • Oh, my gosh, this is such a good, oh, look at it, it's got trans-, transition to serfdom, influence of Christianity, … encyclopedia kind of website, I'm going to get this … It has, like, thingies to Tacitus and everything, see – 'As Tacitus tells us' ….
Chloe, Interview, Study 3 • liked	*Kathy, Journal, Study 1* • very useful • contained the information I wanted
Daniel, Interview, Study 1 • relevant	*Kelvin, Journal, Study 1* • worthwhile
Edward, Interview, Study 3 • fairly good	*Lionel, Interview, Study 3* • quite important
Edward, Think-Aloud, Study 3 • the most obvious links	*Lionel, Think-Aloud, Study 3* • quite interesting • I'm going to use that
Emily, Interview, Study 2 • what I was looking for	*Mark, Interview, Study 2* • on the right track • to do with the question
Gerard, Interview, Study 3 • more stuff in it • what I have to do, question-wise • pretty good	*Mary-Ann, Interview, Study 3* • decent information • interesting
Gerard, Think-Aloud, Study 3 • relevance • looks promising • good	*Mary-Ann, Think-Aloud, Study 3* • promising title

Noah, Interview, Study 1 • useful	*Sophie, Interview, Study 3* • most relevant • liked
Paul, Interview, Study 3 • something good, this is really good, let's read it	*Sophie, Think-Aloud, Study* • really good • really good
Paul2, Think-Aloud, Study 3 • good	*Stefano, Interview, Study 3* • good • pretty good • relevant
Paul2, Interview, Study 3 • help • good	*Stefano, Think-Aloud, Study 3* • good • very relevant • the information I need • useful • tie in • good • a very good website • take information that I need • pretty decent information
Paul, Think-Aloud, Study 3 • I like that	*Vicki, Interview, Study 1* • relevant
Richard, Interview, Study 2 • more or less good reference points	*Victoria, Interview, Study 3* • of any use
Ryan, Interview, Study 1 • good • worth using • things that are worth keeping	
Sharon, Think-Aloud, Study 3 • good essay here … importance of slavery, this one's good … copy that • this is good • that was a good website • it's good	
Sophie, Interview, Study 2 • points that interested me	

Appendix 4.9: Negative references to relevance

Chloe, Interview, Study 2 • not relevant	*Mary-Ann, Think-Aloud, Study 3* • the bad ones you won't find much on
Chloe, Interview, Study 3 • didn't really like that	*Michael, Interview, Study 2* • don't need
Gerard, Interview, Study 3 • really not what I'm looking at • didn't really get much • wasn't very useful • not really useful • didn't look very good	*Paul 2, Interview, Study 3* • useless • don't need
Gerard, Think-Aloud, Study 3 • not really useful • not actually about • a bit of a waste • wasn't useful at all	*Sharon, Interview, Study 3* • *I:* You've got a set of results, um *Sharon*: And they weren't really that good, they weren't really that, very good, 's not what I wanted • off-topic
Kristian, Interview, Study 2 • irrelevant	*Sharon, Think-Aloud, Study 3* • that website's not very good mostly to do with North American slavery history of slavery
Lily, Interview, Study 1 • not relevant • not what we were looking for • useless stuff	*Sophie, Interview, Study 2* • not the information I wanted • wasn't very helpful
Lionel, Interview, Study 3 • not what I want	*Sophie, Think-Aloud, Study 3* • isn't the best
Lionel, Think-Aloud, Study 3 • fruitless	

Appendix 4.10: Students' use of snippets to guide relevance judgements (data extracts)

- *Brian, Interview, Study 1*

  If it said something like 'the pen was invented in the, uh, 1950s or whenever it was', I'd go, 'Oh, yes, that's what I'm looking for and go to that web page … in the little snippet that *Google* gives you.

- *Edward, Interview, Study 3*

  Yeah, definitely, that [bolded words in the search results in *Google*] is definitely a starting point, just to make sure that, um, it is related, you don't want to be going to some bizarre site that just has no reference to anything.

- *Karen, Interview, Study 3*

  I just read in the little blurbs what it said about them and I thought that one had more of what I wanted in the blurb.

- *Karen, Think-Aloud, Study 3*

  It says here the Roman economy was heavily dependent on slavery [*reading from the* Wapedia *site's snippet*] and most were acquired by warfare [*reading from the* Wikipedia *site's snippet*].

- *Mary-Ann, Interview, Study 3*

  I just read the little blurby bit and if it sounds along the lines of what I'm trying to find, then I'll just have a look at it.

- *Paul2, Interview, Study 3*

  … it also depends on how relevant, sometimes they, the extract makes no sense with your wor-, selection of words, so you just don't' select it … .

- *Vicki, Interview, Study 1*

  [*In response to the interviewer's question, 'How do you decide which ones you're going to go to first?':*] Ah, I think the one that has the most bold letters, no, the one that looks … It's more the ones that I think will be relevant, um, mainly the ones at the top and I read the little paragraph underneath and think whether it's going to be relevant or not.

Appendix 4.11 Positive references to reliability

Brian, Interview, Study 1 • affirm	*Karen, Interview, Study 1* • trustworthy
Brian, Journal, Study 1 • validity • affirm	*Kathy, Interview, Study 2* • reliable
Daniel, Interview, Study 1 • make sure • true • correct	*Karen, Interview, Study 3* • it was also like something dot org and I think they're meant to be more trustworthy • dependable
David, Journal, Study 1 • factual	*Kelvin, Journal, Study 1* • accuracy
Edward, Interview, Study 3 • fairly reliable • fairly good • fairly good • a proper website	*Lionel, Think-Aloud, Study 3* • credible
Elizabeth, Interview, Study 2 • credible	*Mary-Ann, Think-Aloud, Study 3* • decent • decent, reliable, scientific sites • smarter-sounding website name
Stefano, Interview, Study 3 • *Wikipedia*'s, these days, seems to be generally legit, so I just went to *Wikipedia*, um had a quick look over what could be relevant • line up • what is true • legitimate • legit • good • pretty good • never failed me • very, very reliable	*Paul, Interview, Study 3* • it looks more credible than *Wikipedia* since it had an author at the bottom and, you know, some citations • reliable • credible • credible • important
Gerard, Interview, Study 3 • trustable	*Ryan, Interview, Study 1* • pretty reliable
Gerard, Think-Aloud, Study 3 • better opinions • good	*Sophie, Interview, Study 3* • legitimate
Sophie, Think-Aloud, Study 3 • good	*Stefano, Think-Aloud, Study 3* • very reliable
Emily, Interview, Study 2 • trustworthy	*Victoria, Think-Aloud, Study 3* • trustworthy

Appendix 4.12: Negative references to reliability

Chloe, Interview, Study 3 • rubbish • unsure *Daniel, Journal, Study 1* • not the most reliable *Edward, Interview, Study 3* • isn't fantastic *Jenny, Interview, Study 1* • aren't necessarily that trustworthy *Kathy, Journal, Study 1* • not a reliable source	*Lily, Interview, Study 1* • useless stuff *Mary-Ann, Think-Aloud, Study 3* • the bad ones you won't find much on *Stefano, Interview, Study 3* • what may not be true *Victoria, Interview, Study 3* • not reliable

Appendix 5.1: Extracts from journals kept by researcher

5.1.1

Overlapping themes:

1. Filtering in the Building knowledge theme overlaps with Pre-access judgement in Convenient/pragmatic approach theme when metadata are used to guide judgements of relevance or reliability.
2. Even a belief that *Wikipedia* will offer the 'basic facts' about a topic is both a pre-access judgement as it is made before accessing a specific *Wikipedia* article, and yet this is also part of the phenomenon I have called relevance priming.
3. Relevance priming is not just the seeking of an introduction or topic overview but may be an identification of prior knowledge, which is then used as the basis of the information search. In this instance, then, there is an overlap with pre-access judgements, although many pre-access judgements seem to relate to prior procedural knowledge (for example, about what category of resources is likely to be profitable), rather than the declarative knowledge that we often associate with 'prior knowledge'.
4. Relevance chaining sometimes required the identification, by a student, of prior knowledge. Here there is an overlap with relevance priming because the priming is already done if the student already has some background in the topic; and, if there is some background, relevance chaining is facilitated. If there is no background, then a priming source must be found before relevance chaining can begin.
5. Within the theme of relevance chaining, I have distinguished between 'Connection made with prior knowledge' and 'Used information found in one source to search for information in other sources'. However, the latter could be said to be an example of the former in that, once the information found in one source is used, it becomes knowledge and if that knowledge is subsequently used in some way, then prior knowledge has been used. I have used the former, in general, to refer to prior or background knowledge the student had before he or she undertook the information search task. The latter was an action typical of the phase after the ISP for a particular task had begun.

5.1.2

Want to convince educators to work with the way students make decisions about information in naturalistic settings; specifically, to 'chuck out the checklist' of traditional evaluation criteria (as exhorted to by Meola (2004)), which are based on classical decision theory but do not reflect the 'good enough', satisficing behaviour of the information seeker.

5.1.3

Degree of generalisation aimed at is low – statements apply to a particular context, to the cases examined. Statements may well apply to most secondary school students but I do not claim that they do. Any educator that wants to know if my findings apply to the group of students they are teaching needs to ask, 'To what extent do my students sound like those in this study? Based on my informal observations of them, how likely are they to behave in ways described in this study?' Theoretical sampling has the potential to increase the generalisation possible because it is designed to uncover as much variation as possible. Also to be considered is the level of within-study generalisation – I wanted my general statements in my conclusions or findings to take in, or account for, all variation of the individual participants, i.e., ideally all individuals' behaviour can be fitted into the general scheme. This should reflect the definition of generalisation in qualitative research that Flick (2006:393) refers to: 'the gradual transfer of findings from case studies and their context to more general and abstract relations, for example a typology'.

5.1.4

Gaining access to the research site entailed readily given access by gatekeeper in role of school principal but then there were other levels to negotiate. Consider Year 9 student who questioned what was in my research for him; and Head of Department who spoke of the need for 'sweet talking' to convince her that students keeping a reflective journal of their ISP would not add to students' already demanding load of assessment tasks to complete. Frustration when a participant did not arrive on time and rescheduling was necessary; when the recording equipment did not work and so we reconstructed the search from the history in the Web browser (Karen); when a participant had to leave half-way through the stimulated recall interview, so I arranged to view the rest of the video and get back to the participant if I had any questions (Lionel). On positive side, regularly asked, particularly by Richard, how doctorate is going. And Vicki kindly agreed to repeat the interview after the first attempt did not record successfully. Stefano noticed, during his think-aloud session, carried out alone, that the recorder wasn't working and came to me to sort that out.

5.1.5

Use of Wikipedia article, as a predominant choice for this, is an attempt to assess the scope of the topic. Once the student has some grasp of the scope of the topic, this then sensitises him or her to what may or may not be relevant. Knowledge of the scope, which is part of prior knowledge (even if very newly acquired), therefore plays an important role in what a student decides is relevant.

Focus within a topic area may be considered a narrow form of topicality. If topicality is the characteristic of any information broadly related to the topic area, then focus is a more limited form of topicality because it limits attention to a subset of all the information that may be relevant to the topic. Teachers sometimes delimit the topic area by requiring a focus on a particular aspect(s) but, even then, there is often room for a student to develop a personal focus.

I wonder if quality evaluation is what unites relevance and reliability. Summative quality evaluations are made by students and are seen in comments about a source, such as that 'it's good'. However, I suspect that relevance takes priority over reliability – an information source is good primarily because it is relevant to the information needs of the searcher.

I'm seeing focus as an evolving phenomenon – sometimes begins with demands of topic as assigned by teacher, then kept in mind by student when undertaking early searches. After that, focus seems to come into play when selecting from the gathered material, and this is achieved through highlighting points, for example, each of which may later form the basis of a paragraph in the completed essay. There may be a subsequent sharpening of focus when it becomes clear that not all points can be included and that amalgamations of points are needed (grouping related points); in this part of the process, some points are likely to fall by the wayside. It appears to be the demands of the word limit that serve to focus the mind on what appear to the learner to be the main points of the topic. The 'framework' that determines the scope of the topic area is often a *Wikipedia* article; such an article is afforded a position of primacy by the learner and although the source is the 'victim' of teacher-induced suspicion with respect to its reliability, in fact becomes the basis of learning, probably mainly because its content is corroborated by other sources. Teacher attitudes to *Wikipedia* often create a double-bind situation for the student in that its reliability is questioned but its apparently weak foundations are reinforced by the corroborating sources. It is as if the bastard parent, Wikipedia, gives birth to a legitimate child, the end product, but the teacher must remain blissfully ignorant of the dubious lineage.

5.1.6

Westbrook (2006:574-6) is potentially useful in at least three respects: it's a small-scale, qualitative, exploratory study like mine; it identifies three mental models, against which I could compare my findings; and it offers suggestions on how information seeking among students with the models identified may be improved.

The method that I use for capturing data related to students' thinking aloud is probably more commonly captured in an interview that is 'normally labeled the *concurrent* interview because the investigator asks the student to verbalize his or her thoughts at the same time the task is being solved' (Leighton & Gierl 2007:151). The interview that I conduct after the think-aloud segment is 'normally labeled the *retrospective* interview because the investigator asks the students to think back and recollect the problem-solving processes used' (Leighton & Gierl 2007:151).

Ref.: Leighton, J.P. & Gierl, M.J. 2007, 'Verbal Reports as Data for Cognitive Diagnostic Assessment', in Leighton, J.P. & Gierl, M.J (Eds.), *Cognitive Diagnostic Assessment for Education: Theory and Applications*, Cambridge University Press, Cambridge, pp. 146-172.

5.1.7

Study 1: 16 students; Study 2: 14 students; Study 3: 11 students (minus four, who took part in Study 2, giving seven unique students in Study 3).So, instead of 16+14+11, which gives 41, the correct calculation is 16+14+7, which gives 37.

There are 39 cases in the data matrices in the appendices of my thesis; these are from 34 students (Paul contributed data twice, and four students participated in both Studies 2 and 3; thus, five must be subtracted from what appear to be 39 cases). The reason that there are 34 cases, rather than 37, is that the contributions of Ethan, James and Robert did not lend themselves to analysis in *NVivo* (mainly because they were not interviewed). In other words, to the number of 34 unique cases in the data matrices must be added the three students from Study 1, whose data contributions were insubstantial; this gives a total number of 37 participants, even if only 34 contributed effective data.

Study	No. of participants	Intervening factor	Effective no. of participants	Total in each study
1	16	Three students' non-participation in interviews resulted in insufficient substantial data from them	13	16
2	14	Nil	14	14
3	11	Four students from Study 2 participated again	7 unique to Study 3	7
Total			34	37