# CHAPTER 4

# ESTABLISHING A CONCEPTUAL FRAMEWORK FOR INFORMATION LITERACY LEARNING: Cycle 3

## Introduction

Chapter 2 explored the heritage of information literacy learning in the rich practitioner base of writings from the field of resource-based learning and technology-based learning. It suggested that the explicitly constructivist approach of many current TBL projects highlighted characteristics of learning absent from less successful RBL projects.

This chapter considers constructivism and posits three main characteristics of constructivist information literacy learning - that it is student-centred, self-regulated, self-reflective (control); mediated, scaffolded, guided (coached), contextualised within the curriculum and within the experience of learners (context). The three characteristics (control, coach, context) were anticipated in the writings of Lev Vygotsky and Vygotsky's work provides an overarching theoretical perspective for examining a constructivist approach to information literacy learning, and other theories which appear to support constructivist information literacy learning principles. These theories illuminate the dimensions of student-centredness, student control, self-regulated, 'deep', metacognitive, strategy-enhanced, active, cooperative, skill-focused learning which are hypothesised as characterising effective information literacy learning.

## Information literacy learning and constructivism

What characterises the literature on the resource-based learning precursors of information literacy learning is an absence of grounding or underpinning in educational theory. There is agreement that information and cognitive skills are needed; there is agreement that providing a process framework of stages helps guide the use of these skills; there is agreement, at least in principle, that the purpose is not the collation of facts, but the construction of *knowledge* by the learner. Recent work is implicitly 'constructivist' in its ideology, yet constructivism and constructivist writers are seldom cited by information literacy writers. Similarly unacknowledged, behaviourist and cognitivist information processing ideas underpin earlier library and bibliographic instruction work (McLellan, 1996b). While these RBL studies generated valuable evidence about problems encountered by students and teachers, the lack of theoretical grounding has limited their capacity to generate coherent pedagogy. In contrast, many TBL projects are explicitly constructivist.

While the broad and generalist nature of constructivism may preclude rigorous theoretical analysis, it provides a useful umbrella of shared principles under which theories and approaches can be clustered to provide synergy and mutually supporting insights.

> *(W)e feel that the use of multiple theories of learning provides an opportunity to capitalize on the individual strengths and the synergistic combination of varied perspectives* (Jacobson & Jacobson, 1993, p. 20).

From this point in the study *information literacy* is interpreted as including both RBL and TBL, acknowledging that differences might remain professionally, but conceptually and pedagogically it is more profitable to consider them as synergistic.

Developments in the theoretical dimensions of constructivism (for example, Steffe & Gale, 1995; von Glasersfeld, 1995) initially appeared to suggest welcome rigour in applying constructivist principles to information literacy pedagogy. In fact, as the study evolved, the value of constructivism was seen to lie in its broad-based all-encompassing nature that is so dissatisfying to its critics (for example, Allen, 1992; Fosnot, 1992; 1996; Tobias, 1992). Reibel and Wood suggest that:

> *Constructivism is actually a collection of theories and ideas about different issues in pedagogy that are informed by a range of philosophical/ epistemological outlooks. Some of these conceptions are incommensurate with each other; others complement each other* (1991, p. 1).

Attempts to define and map the boundaries of constructivism as a theory have given rise to several dimensions: 'trivial constructivism', 'radical constructivism', 'sociocultural cognition', 'social constructivism', 'social constructionism' (Ernest, 1995; Steffe & Gale, 1995) Little of this current debate appears to have direct *pedagogical* relevance. It appears grounded in Snelbecker's 'knowledge producer' (theorist) paradigm (1983). Relevance to a constructivist pedagogy is barely explored, although there is some discussion of the value of the child's individual construction of knowledge in relation to the 'accepted truth' of socially mediated scientific knowledge (Driver, Asoko, Leach, Mortimer, & Scott, 1994; Laurillard, 1987). What is meant by the construction of knowledge needs to be debated at a pedagogic level in relation to learning seen as constructing knowledge from and with 'textualised' information (Richardson, 1997b).

Some of the most challenging and interesting constructivist *pedagogical* debate has emerged in the periodical, *Educational Technology,* contributed to by educators like Perkins, Duffy, Cunningham, Jonassen, and the CTGV writers. Cunningham suggests that "(p)erhaps the most distinguishing feature of constructivism... is its emphasis on argument, discussion, and debate" (1991, p. 26). Many of these contributors to the debate work at both theoretical and research and development levels. Technology-based research and development projects are being subjected to theoretical scrutiny in the light of a number of emerging perspectives related to constructivism (such as situated cognition, cognitive apprenticeship, anchored instruction, cooperative learning, reciprocal teaching and cognitive flexibility), and at the same time the theoretical assumptions are being tested in classrooms (for example, Dick, 1991; Richardson, 1997a).

Jacobson and Jacobson (1993, p. 129) outline three major themes in what they call 'representative cognitive learning theories':

- active role of the learner in constructing her or his own knowledge;
- importance of learning in knowledge-rich contexts;
- theory and research based on characteristics of competent or expert performance.

These, together with the *role of the teacher as coach and scaffolder,* and the notion of an *authentic learning environment* emerge as characteristics of the knowledge construction environments surveyed previously. While some of the terminology (for example, *authentic learning environments*) has evolved within the context of constructivism, what the terms stand for also converges with the characteristics of what has been hypothesised and demonstrated as characteristic of successful resource-based and information skills learning (for example, McNicholas, 1994; Todd, McNicholas, & Sivanesarajah, 1992).

In the area of technology-enhanced generative learning environments educators have used insights from a range of outlooks. Work in situated cognition (for example, Barron & Goldman, 1994; Brown, Collins, & Duguid, 1989; Collins, 1991; Resnick, Levine, & Teasley, 1991, p.4; Young, 1993) and in anchored instruction (Cognition and

Technology Group at Vanderbilt, 1991a; 1991b; 1992; 1993a; 1993b; 1994a; 1994b) has extended insights into the contexts that support student-controlled, teacher/ resource-scaffolded learning. CTGV describe anchored instruction as "instruction situated in engaging, problem-rich environments that allow sustained exploration by students and teachers" (Cognition and Technology Group at Vanderbilt, 1992, p. 65). Hannafin says of anchored instruction and situated cognition:

> *Such perspectives view cognition and the circumstances supporting learning as inseparable. Rather than decontextualizing learning by isolating and making explicit 'required' elements, it may be fundamentally more productive to embed desired elements within 'authentic' activities wherein the knowledge and skills naturally reside* (1992, p. 53).

Jacobson and Jacobson (1993, p. 129) list themes characteristic of situated cognition: knowledge-rich 'authentic' situations; modeling; coaching and scaffolding; fading; collective problem solving; display multiple roles; articulation, reflection, and confronting misconceptions; collaborative learning. These themes frequently reflect in work done in the reciprocal and collaborative learning areas (for example, Brown, Collins, & Duguid, 1989; Duffy, Lowyck, & Jonassen, 1991; Resnick et al., 1991; Savery & Duffy, 1995). These characteristics are also reflected in work in distributed cognition or distributed intelligence (for example, Farnham-Diggory, 1990, p. 63; Savery & Duffy, 1995, p. 1). Similarly, work in cognitive apprenticeship relates to and merges with work in authentic learning (Brown, Collins, & Duguid, 1989; Farnham-Diggory, 1990; Harley, 1993; Hay, 1993; McLellan, 1993; Moore & CTGV, 1994; Savery & Duffy, 1995).

Cognitive Flexibility Theory (1991a; Spiro et al., 1991b) adds new dimensions to those above. In discussing Cognitive Flexibility Hypertexts (CFHs) Spiro, Feltovich, Jacobson and Coulsen suggest that "CFHs are for case-based instruction in complex and ill-structured domains for the purposes of advanced knowledge acquisition", and acknowledge the cognitive demands made (1995, p. 24). Multiple knowledge representations characterise ill-structured domains, and help to ensure transfer through "the multidimensional and nonlinear 'criss-crossing' of the conceptual and case landscapes" (ibid., 1995, p. 22). By emphasising conceptual interrelatedness, linking abstract concepts to case examples, they answer some of the criticisms levelled at constructivism (Hargreaves, 1994; Layton, 1993; Winn, 1994) in providing for multiple ways of knowing, conceptual coherence, and guidance to make the connections that ensure transfer. Similarly, connectionism (for example, Bereiter, 1991; Hannafin, 1992), emphasises the need for relationships among concepts to be made explicit; something that, as Spiro and his colleagues demonstrate with CFH, computers can facilitate (see also, Alexander, Kulikowich, & Jetton, 1994; Jonassen, 1996).

The teacher's role is seen as crucial in negotiating, coaching, and providing scaffolding and support. The difficulties teachers encounter teaching in RBL and TBL environments are thoroughly documented (Bagley & Hunter, 1992; Best, Abbott, & Taylor, 1990; Brown, 1994b; Cowley, 1990; Crook, 1994; Honebein, Duffy, & Fishman, 1991; Kuhlthau, 1990; Lee & Kazlauskas, 1995; Meichenbaum & Biemiller, 1998; Reibel & Wood, 1991; Spiro et al., 1995; 1991b). Defining and explicating roles for both learners and teachers becomes a significant concern in developing a constructivist learning framework.

Perkins suggests that what characterises constructivism is rich and complex learning environments (Perkins, 1991b, p. 19). Perkin's 'phenomenaria' (ibid., p. 19), Bereiter's 'problem-centered' learning (1992), resource-based learning 'projects' (Jonassen, 1991; 1994) 'microworlds' (Crook, 1994; Dede, 1992; Harel & Papert, 1992; Jonassen, 1996), Spiro and Feltovich's CFHs (1995; 1991a; 1991b) and 'situated learning' by means of 'anchored instruction' (for example, the CTGV projects) can all be described as knowledge construction environments because they embrace the fundamental constructivist principle of constructing knowledge, although the nature of the knowledge and the nature of the construction process need to be defined more precisely unless constructivism is to be interpreted too broadly to be useful.

What Spiro and his colleagues say of Cognitive Flexibility Hypertexts may relate to many IT-enhanced knowledge construction environments:

> *...CFHs provide exploration environments, organized around building blocks for knowledge assembly, that are useful for a process of constructivist thinking that is inculcated... CFHs would be useless in preparing learners to apply their knowledge widely to new cases (the learning objective of transfer) if they did not teach both the learning skills of context-dependent, multidimensional, noncompartmentalized knowledge acquisition, and the application skills of flexible, situation-sensitive knowledge assembly (those skills that are characteristic of a particular domain and those that are of more general utility)* (1991a, pp. 23 - 24).

Simons quotes Shuell's definition of constructive learning:

> *... an active, constructive, cumulative and goal directed process... It is active in that the student must do certain things while processing incoming information in order to learn the material in a meaningful manner. It is cumulative in that all new learning builds upon and/ or utilizes the learner's prior knowledge in ways that determine what and how much is learned. It is goal oriented in that learning is most likely to be successful if the learner is aware of the goal (at least in a general sense) toward which he or she is working and processes expectations that are appropriate for attaining the desired outcome* (1991, p. 291).

While it could be argued that all learning involves the construction of knowledge (Zucchermaglio, 1991, p. 253), knowledge construction environments incorporate and emphasise the elements of *student control of learning* and *teacher mediation of learning.* The learning in these environments is clearly intended to be learner-centred rather than teacher-directed, and to be deep rather than surface (Biggs & Moore, 1993, p. 307). Novak suggests:

> *What really counts, in my view, is how to empower human beings to optimize their phenomenal capacity for meaning making, including their awareness and confidence in processes that are involved. This capacity for meaning making is what I refer to as human constructivism* (1990, 20).

Collins says, "The constructivist view... argues that the goal of education is to help students construct their own understandings" (1996, p. 347). Candy identifies two concerns in constructivism, "how learners *construe* (or interpret) events and ideas, and how they *construct* (build or assemble) structures of meaning" (1991, p. 272). The teacher's role is "to help students confront the reality of their ideas" (Assessment of Performance Unit, 1993, p. 66); to become self-reflective, metacognitive, meaning-making learners. Candy says, "The logic of *reconstruction*, thus, becomes crucial to the didactic endeavour..." (1991, p. 273). This is distinct from CAI/ ILS environments where the computer-as-teacher-substitute controls the learning, even if individualised and personalised one-to-one-with-technology responses may give the learner an illusion of control.

Projects are seen by many as providing an optimum context for authentic learning in a constructivist environment (for example, Barron & Goldman, 1994; Berliner, 1992; Hannafin, 1992; Knapp & Glenn, 1996; Perkins, 1991b; Reibel & Wood, 1991). It is salutary, however, to note that the concerns that are being voiced, coincide with the negative RBL findings (see Appendix 1).

## Concerns and constraints

Perkins (1991a, p. 19) is among several who note the need for scaffolding to guide the learning, and the need for excellent teaching (see also Appendix 1, and Brown, 1994b; Lee & Reigeluth, 1994; Rushkoff, 1996). Perkins also points out the significant demands the constructivist learning environment places on the learner (1991b, p. 19). Similarly, Bagley and Hunter (1992) see these learning experiences as time and skill-consuming and appropriate neither for young primary nor older secondary students, but mainly for the middle years. Reibel and Wood (1991) point out that there is no evidence

of transfer of skills or process from one resource-based learning or problem-solving context to another. Crook (1994, p. 77) poses the same question in relation to microworlds. Spiro, Feltovich, Jacobsen and Coulsen (1995; 1991a; 1991b) see the need to build into their hypertext software what they call 'crisscrossing the landscape' strategies to ensure transfer through repetitions and 'multiple perspectives'. Honebein, Duffy and Fishman (1991, p. 94) join Spiro and colleagues in suggesting that these environments need to retain their complexity to achieve transfer. Understanding developed in simplified computer-based stimulus environments, he claims, is quite different from the understanding that develops in the "full stimulus environment."

Cole (1992, p. 32) points out the inherent possibility in these environments that every student might be expected to construct knowledge in a similar way. Dick suggests the opposite, that "constructivists seem to offer the learner almost unlimited discretion to select what is studied, from available resources, and how it is studied. What accountability is there that students will learn?" (1991, p. 44).

Robertson (1991) claims that in an age of instant gratification, students demand instant pre-synthesised, collated and integrated knowledge. The demands of leaping from knowledge telling to knowledge transforming (Bereiter & Scardamalia, 1989) may not seem worth the effort. Many children like to be directed, prefer working in teacher-structured learning environments, and have an expectation that learning is what teachers do to students (Bereiter, 1992; Brown, 1994b, p. 150; Ehrmann & Balestri, 1992; Farmer & Mech, 1992, p. 354; Simons, 1991). Spiro and colleagues identify a key point in relation to knowledge construction environments in asking 'how much structure?' (1991b; see also Brown, 1994b, p. 150; ). The teacher's role in establishing a balance between too much and too little structure appears crucial in a constructivist learning environment (Berliner, 1992).

Bereiter (1992) claims that most project-type constructivist-oriented learning remains referent or centred on fact reproduction rather than problem-centred (ibid., p. 348) and that children do not understand the underlying constructivist message (ibid., p. 354) This is congruent with the findings of earlier resource-based learning projects.

**Summary**: In short, constructivism provides a convenient umbrella to begin to make links between the fields that have contributed to this emerging field of information literacy, and to harness some of the practitioner knowledge and pedagogical insights emerging from the constituent fields to constructivist thinking. However, constructivism must be defined more closely by the context in which it is applied to be regarded as anything more than a slogan.

There is now a significant body of constructivist writing in the field of learning/ education (for example, Steffe & Gale, 1995), but the pedagogical implications have only been explored in any depth in the fields of science and mathematics education (Cobb, 1994; Driver et al., 1994; Phillips, 1995; Steffe & Gale, 1995). Work is beginning in applying constructivist thinking to literacy (for example, Chan, Burtis, Scardamalia, & Bereiter, 1992; Hogan & Pressley, 1997; Newman, Griffin, & Cole, 1989). However, other than in maths and science education, it is only in the field of technology-based learning (as outlined above) that significant and explicit attempts have been made to date to explore the pedagogical implications of constructivism in classroom-based learning. These attempts have been, in particular, in the areas of situated cognition and cognitive apprenticeship (Barron et al., 1994; Brown, Collins, & Duguid, 1989; McLellan, 1994; 1996b; Resnick, Levine, & Teasley, 1991; Young, 1993), anchored instruction (for example, Cognition and Technology Group at Vanderbilt, 1993a), and Cognitive Flexibility Theory (1991a; Spiro et al., 1991b).

## Relevance of constructivist thinking to information literacy pedagogy

Jonassen summarises general attributes of constructivist learning, seeing it as more process than product-oriented, emphasising *negotiation* ('internal' and 'social') of *real-world environments* which provide *authentic, meaningful contexts for learning* which

stimulate *reflection.* The teacher's role is seen as crucial in negotiating, coaching and providing scaffolding and support (1994, p. 37).

This summary provides a useful framework for developing a constructivist information literacy pedagogy. It also provides a focus for drawing together many of the features of resource-based, information literacy and technology-enhanced learning emerging from the literature. Similarly it provides a context against which the characteristics of more specific theoretical and pedagogical developments can be analysed, and compared to extend the learning potential of constructivist learning environments, for example, *situated cognition* and *anchored instruction, cognitive apprenticeship, cognitive flexibility theory* and *distributed cognition, reciprocal teaching* and *collaborative learning.*

From the intersection of work in RBL and TBL pedagogical insights into information literacy learning can be extrapolated. These include:

Learning set in the context of **rich and complex learning environments** is authentic in the sense of being relevant to student interests and needs (Bereiter, 1992; Cognition and Technology Group at Vanderbilt, 1992; Crook, 1994; Dede, 1992; Harel & Papert, 1992; Honebein, Duffy & Fishman, 1991; Jonassen, 1991; Perkins, 1991b; Spiro et al., 1991a).

Earlier resource-based and information skill studies seldom provided authentic environments, seldom offered students guidance to give the information search and topic purpose and meaning (see summaries: Winkworth, 1977; British Library, 1990; Heeks, 1989; Irving, 1983; Rogers, 1994).

Learning is **mediated** by systematic teaching, modelling, coaching, guidance or scaffolding provided by the teacher, peers *or* resources/software (Brown, 1994b; Cognition and Technology Group at Vanderbilt, 1991a; 1991b; 1991c; 1992; 1993a; 1993b; 1994a; 1994b; Lee & Kazlauskas, 1995; Perkins, 1991a; 1991b; Spiro et al., 1991b).

This need for mediation is, arguably, the most common and significant finding of the 1970/ 80s and subsequent resource-based learning projects, with Australian and Canadian literature, in particular, emphasising the benefits of teacher-librarian and classroom teachers working collaboratively (Dawson, 1989; Eden, 1989; Kallenberger, 1989a; 1989b; Leslie, 1989). Information process frameworks are seen as aiding mediation, particularly with regard to information retrieval, but with less conviction in the interpretative, generative, transformative dimensions of knowledge construction. The researcher's adaptation of the Irving/ Marland 9-stage framework (Marland, 1981), for example, was developed into a scaffolded 175-hour teacher training programme and pedagogy completed by ten per cent of New Zealand teachers:

1. DECIDING (defining the problem)
2. FINDING (identifying sources of information and retrieving information)
3. USING (using/ 'interviewing' information selectively and analytically for understanding)
4. RECORDING (noting and synthesising - notes, diagrams, pictorially - relevant information)
5. PRESENTING (communicating the knowledge generated from the information)
6. EVALUATING (the knowledge product and the information search and generation process. (Gawith, 1984; 1987; 1998).

Learners control and 'own' their learning by being given guidance in necessary learning, thinking, self-efficacy, self-regulation and planning skills. This includes guidance in choosing topics, setting goals, planning, selecting appropriate learning experiences, resources and technologies, and using metacognition and 'meta-learning' skills to monitor and evaluate the learning (Beynon, 1993; Cole, 1992; Dede, 1992; Duffy & Jonassen, 1991; Honebein, Duffy, & Fishman, 1991; Kay, 1991; Knuth & Cunningham, 1991; Lee & Kazlauskas, 1995; Reigeluth & Garfinkle, 1992).

The rationale for resource-based learning and information skills programmes is often the development of autonomous self-directed lifelong learners (for example, Bruce, 1996b). There is, however, no evidence that these programmes have significant impact on learning habits and attitudes. While there is, as suggested above, similarly sparse evidence of impact on learning of the IT-enhanced knowledge construction generative learning projects, the difference between them is the greater recognition by educational technology researchers that the 'missing link' may well reside in greater student use of metacognitive and metalearning, critical and analytical, discriminatory and synthetic thinking and problem-solving strategies. This may be explained by their more explicit commitment to constructivist learning principles.

The limited amount of research which examines the use of information process frameworks in Australasia, suggests that the social, cooperative nature of the learning, the scaffolded, question-driven focus on metalearning strategies (highlighted by Biggs, 1987a; 1987b; 1987), and the motivating effect of giving students the self-management and cognitive tools to control their learning are common denominators of 'success' (Curwood, 1995; Gawith, 1998; Lealand, 1991; McNicholas, 1994; Todd, McNicholas, & Sivanesarajah, 1991; Todd, McNicholas, & Sivanesarajah, 1992; Todd, 1995). In addition, the researcher had the benefit of moderating, nationally, the work produced by students on New Zealand's national information studies diploma courses for practising teachers over a seven year period, 1991 - 1997 (some 6,000 teachers and over 75,000 pieces of work). Each of the six information process stages was modelled for teachers, practised by teachers, and then implemented in the classroom. The strongest and weakest in each batch of student work was sent to the researcher for moderation. The data generated (unpublished) significantly influenced the researcher's thinking and the development of this study. Recognising that the extent to which learners were able to gain ownership and control over this type of learning depended as much on contextual factors as on the student her/ himself, the researcher published a prototype of the 'control, context, coach' model developed in this study (Gawith, 1993). While this was never 'tested' formally, the course moderation data validated her belief that encouraging teachers to think holistically but systematically about the contextual factors that impinged on this type of learning (including time, availability of resources, level of resources, prior knowledge (content and procedural), curriculum objectives, and the like), significantly improved teachers' ability to visualise, plan, teach, monitor and evaluate information literacy learning. It also reflected (see below) the extent to which Vygotsky's work had influenced the design of the pedagogy which translated her 1983 adaptation of the 6-stage information process framework into the pedagogy which informed the national 175 hour 'Infolink' course.

In essence, there *is* an Australasian precedent based in research, albeit small, for a constructivist approach to student-centred resource-based learning using information process frameworks which evidences the characteristics listed above.

Interestingly, and bearing out the points made previously about parallel developments (and emerging synergies) in relatively discrete fields of RBL, TBL and learning design, Duffy and Cunningham have subsequently noted the same features of control, context and coaching (see below), and have produced a 6-stage framework, a 'Preliminary analysis of the skills and knowledge required in the corporate and community education program at Indiana University' which differs from the researcher's 1983 adaptation of the 1981 Riving/ Marland framework only in it's broader emphasis on learning rather than learning from information (Duffy & Cunningham, 1996 pp. 184 - 185, 192).

> *A teacher does not have to be physically present for learning to be teacher-dependent. Project work, distance learning resource-based learning, Keller Plan, programmed learning, essay writing, seminar preparation, background reading: all of these may or may not incorporate elements of student control over learning, but by no means do they imply independence* (Candy, 1991, p. 206).

Candy's distinction between student control and independence is a useful one. It helps explain the contrast between the claims made for the *potential* of resource-based, project-based learning for enhancing authenticity and motivation (for example, Brown, Collins,

& Duguid, 1989, p. 3; Bruer, 1993, p. 267; Levin, 1994, p. 16; Rogers, 1994, p. 15; Sternberg, 1990, p. 187) and the researched reality of many of the 1970/ 80s studies where students are given independence, but not the skills to use it. The less successful resource-based learning projects were characterised by teacher-centredness and lack of teacher guidance for student control of learning. Ironically, too, approaches are emerging under the constructivist 'bandwagon' which provide extraordinarily naive versions of RBL. One such calls it 'Group Investigation', reinventing 'projects' as investigations based on the age-old assumption that, given a topic, children will be able to 'look it up and write it up' (Marlowe & Page, 1998). Others invoke 'inquiry' and information technology to describe simplistic, idealised 'constructivist' 'projects' (Knapp & Glenn, 1996, p. 112).

## Characteristics of constructivist information literacy learning

From this review it is suggested that:

- student control of learning is fundamental to the concept of learner-centred learning;
- the concept of learner-centredness and student control of learning is fundamental to constructivism;
- information process frameworks are predicated on the notion of students learning to control their own resource-based learning with teacher guidance;
- the New Zealand curriculum is fundamentally constructivist; information literacy learning is mandated; therefore information literacy learning should be implemented using learner-centred constructivist approaches emphasising control as defined above.

The features seen to characterise constructivist approaches to information literacy learning have been distilled into three characteristics. It is suggested that student control of learning is the most significant principle which underpins constructivist information literacy learning and that 'success' will ultimately always be a flexible, situation-specific balance between the elements of control, coaching and context.

It is assumed that students need to learn to control information literacy learning by being coached by a mediator (usually the teacher) to take responsibility for the cognitive and management dimensions of the learning, and that this learning should be contextualised within curriculum and classroom, in complex, well-designed, well-resourced learning and social environments.

These three characteristics (abbreviated as **context, control, coach**) have been examined below as assumptions, related to Vygotsky's work as a guiding metaphor, and to a number of theories and pedagogies.

## Vygotsky's work as a guiding metaphor

Vygotsky sees learners as central to the learning; sees learning and thinking as socially mediated processes both reflecting and shaping the social context of the learner, and sees learners as actively constructing their own meanings, guided where appropriate (1962; 1978). Vygotsky anticipates the problems and challenges of learning in an 'information age' in the central role he saw played by the sign and symbol systems of the culture (1978, p. 54). His later work on the zone of proximal development supports the assumption that students need to be guided by teachers or more skilled peers toward independence on tasks which they would not have been able to do successfully alone, and anticipates many of the monitoring, coaching, and fading techniques which may need to be built into a constructivist framework for information literacy learning (1978, p. 131) or into software (Jonassen, 1996; Rushkoff, 1996).

Classroom practitioners whose job is, by definition, multifaceted and multidisciplinary, are often caught between the cross-currents of various competing and apparently contradictory theories, but cannot afford the luxury of allegiance to any one theory or

school of theorists (Laurillard, 1987). The power of Vygotsky's ideas transcends theoretical rifts and provides coherence to the many approaches (theoretical and pedagogic) which are clustered under the umbrella of constructivism. For example, Resnick highlights three elements of contemporary cognitive science which relate information literacy to Vygotskian principles:

> *Current cognitive theory emphasizes three interrelated aspects of learning that, together, call for forms of instructional theory very different from those that grew out of earlier associationist and behaviorist psychologies. First, learning is a process of knowledge construction, not of knowledge recording or absorption. Second, learning is knowledge-dependent; people use current knowledge to construct new knowledge. Third, learning is highly tuned to the situation in which it takes place... Cognitive theories tell us that learning occurs not by recording information but interpreting it* (Resnick, 1989a, p.1).

Piaget's view of learning was essentially, like Vygotsky's, constructivist in its emphasis on the learner as an active constructor of meanings (McGuinness, 1993, p. 309; Paris, & Oka, 1986, p. 32). However, Piaget, like many cognitive psychologists, put greater emphasis on learning as individual performance on decontextualised cognitive tasks determined by developmental stages (Brown, Collins, & Duiguid, 1989, p. 396; Gredler, 1992, p. 10; McGuinness, 1993, p. 309). Vygotsky acknowledged age-related development but emphasised the social nature of the learning process (Moll, 1990b, p. 155; Mulcahy, Short, & Andrews, 1991, p. 12), and the role of formal schooling and interaction between teacher and learner in the learning (Vygotsky, 1978, pp. 80 - 81).

These ideas are germane to the pedagogic characteristics of information literacy learning. Vygotsky's theory provides a useful focus for looking at what we mean by students actively controlling their own learning and constructing their own knowledge in an age of information. It also provides a useful focus for considering the role of teachers in helping students to control their learning, and establishing and interpreting a context for learning.

Mercer suggests "If we are seriously interested in how children gain educationally relevant knowledge and understanding, the meaning of classroom tasks to them cannot be ignored" and describes a Neo-Vygotskian perspective as "how processes of education function as ways of acquiring and sharing cultural knowledge which itself serves to contextualize new activities and problems where they are encountered" (1992, p. 35). This recognises information literacy learning as context-dependent; a social process of using cultural knowledge to construct knowledge. Curriculum topic, resources, student need, interest and ability, social and classroom culture and teacher style are all context variables which contribute to information literacy learning as an essentially social and contextualized approach to learning.

Vygotsky's view anticipated the ideas of situated cognition and cognitive apprenticeship (Collins, Brown, & Newman, 1989; McGuinness, 1993, p. 313). Brown, Collins and Duguid attribute much contemporary work in the area of situated cognition to the work of Vygotsky and his colleagues (1989, pp. 1, 10).

In identifying characteristics of powerful learning environments McGuinness says:

> *These developments point to learning and thinking as socially mediated constructions rather than individual mental representations. The emergent view is of 'situated' cognition...* (1993, pp. 7, 306).

McGuinness emphasises the importance of reflection within cognitive apprenticeship models (ibid. , p. 311). Discussing the knowledge explosion, Beswick says "our present educational practices cannot be understood except as the result of the unco-ordinated responses to half acknowledged pressures" (1977, p. 12). The consequences of the information explosion are one such pressure, and Beswick presents a view of resource-based learning as essentially social. The social and reflective nature of successful information literacy learning sits comfortably within Vygotsky's and the situated cognition perspective.

Vygotsky emphasises the relationship between organised learning and development:

> *(L)earning is not development; however, properly organized learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning* (1978, p. 90).

Underpinning the design of the existing New Zealand information process framework was the recognition of the need for 'scaffolded' resource-based learning to combat the project 'collectomania' syndrome (Gawith, 1987). It was designed to support both individualised and cooperative learning, with clearly defined roles and expectations for student and teachers, centred on interesting, resource-rich topics. Course records suggest its effectiveness as a teaching tool, but its inadequacy as a tool for teachers to plan learning environments, and the inadequate base it provides for ensuring that what is constructed from information is socially and culturally meaningful *knowledge,* not 'information pastiches'.

Biggs cites Resnick and Sternberg in suggesting that "school learning differs from everyday learning in several ways", one being that the "content learned in school is, for the most part, a codified abstraction and formalisation of what others have discovered" (Biggs, 1991, p. 7). His notion of "the accumulating cultural heritage and skills necessary for operating in an increasingly complex society" relates well to Vygotsky's view of formal learning and sign systems, and the rationale for information literacy learning (ibid., p. 7).

Moll points out that although, within the zone of proximal development, Vygotsky shifted his emphasis from "sign-mediated to socially mediated activity", he did not discard his emphasis on the importance of instruments (and mediation) in learning and development (1990a, p. 5). Given the centrality of information resources and information technologies to information literacy learning, this is useful for informing, not so much the 'context, control, coach' assumptions, but the *pedagogy* proceeding from them.

Rushkoff (1996) makes a passionate plea for acknowledgment of the extent to which sign and semiotic systems (including graffiti, dress, web design, media, computer games, skateboarding, snowboarding and talk) converge to *define* what he calls the 'screenager's' reality, and determine a level of everyday visual literacy which is not extended to embrace school learning unless harnessed and elaborated by teachers. It suggests that, in Vygotskian terms, their optimal ZPDs may be located in their everyday rather than their school realities. The former, Rushkoff suggests, are under their control. The latter belong to teachers, and it raises the interesting question of whether authentic learning is possible in a systemic reality over which students perceive no ownership or control (1996; see also, Sanger, 1989, p. 293).

Vygotsky defines the zone of proximal development (ZPD) as:

> *the distance between the actual developmental level as determined by independent problem solving and the level of potential as determined through problem solving under adult guidance or in collaboration with more capable peers* (1978, p. 86).

Brown and Palinscar comment that, according to Vygotsky, social interaction creates zones of proximal development, and "social settings provide learning zones for novices" often involving "informal apprenticeships where the teaching function is a minor part of the total activity" (1989, pp. 409 - 410). Lave comments on the different interpretations of Vygotsky's zone of proximal development, and outlines a "scaffolding interpretation" which relates well to information literacy learning. She claims that this "scaffolding interpretation has inspired pedagogical approaches that explicitly provide support for the initial performance of tasks to be later performed without assistance" (1991, p. 48). Clay (1990) gives an example of the explicit use of Vygotskian principles to create such a pedagogical approach in New Zealand (Reading Recovery). Resnick claims that Vygotsky "conceived of cognitive development as a process of internalizing concepts, values, and modes of thought that are initially practiced in social interaction with adults", and defines scaffolding as "performances in which other people, or by extension tools and devices, carry part of the performance load" (1989a, p. 10). Rushkoff's 'screenage' reality, again, requires that we broaden this frame of reference. Experts and novice screenagers teach each other, and signal the need to pay more attention, if we are to bridge

the gap between screenage reality and school reality, to pedagogies which include teaching *students* the notion of the ZPD, and encouraging peer tutoring within ZPDs. This addresses Duffy and Cunningham's concern that although reciprocal teaching (1984) is often cited as constructivist, it is teacher-led not learner-centred (1996, p. 171).

This view of the ZPD is congruent with the assumption that coaching by teacher or skilled peers encourages strategic information literacy learning. Paris, Lipson and Wixson suggest that "[m]otivation and metacognition arise in part from the social interactions of instruction" (1983, p. 294). Garner cites Wertsch's work on coaching and urges "consideration of Vygotsky's notion that capacity for independent strategic functioning evolves from social interaction of an expert... and novice" (1987, p. 28).

Gredler comments that "(t)he theory developed by Lev Vygotsky did not address the development of self-esteem in the classroom" but relates his "recommendation for collaborative learning tasks in which teacher and student both take responsibility for learning" to Bandura and Weiner's work on the concept of self. She goes on to say that "(o)f particular importance is his view that students must learn the signs and symbols of the culture as a mechanism for mastering their own behavior as well as for the purpose of communication" (1992, p. 401). This is congruent with the assumption that learning must be authenticated and the student coached to develop an identity as a 'learner' in an information society, with the implicit assumption that this will enhance the student's concept of self, encourage self-regulated learning, and be intrinsically motivating. Bandura's work provides insight into what constitutes 'control' and has been explored later in the chapter.

Zimmerman comments on "a number of prominent psychologists" who have incorporated Vygotskian views of self-regulated learning into their work (1989, p. 16). Pintrich and Schrauben show how a social cognitive model of student motivation embraces Vygotsky's view of the social context of learning and, in particular, the *context* assumption (1992, p. 151).

**Summary**: Vygotsky's work provides a cohesive context for examining the characteristics of information literacy learning. In broad terms his principles support the 'context, control, coach' assumptions, but also invite a redefinition of the pedagogical approaches adopted in applying it in classrooms. It contributes significantly at all levels - ontological, epistemological, pedagogical - to an emerging theory of constructivist information literacy learning.

## Additional theories and models of learning contributing to information literacy learning

Posner comments on the value of theories used as an interpretative perspective (1991, p. 28). All of the theories and models discussed below interpret the notion of empowering learners to construct knowledge. It is not suggested that they are therefore constructivist. However, because these theories and models subscribe to principles which some currently call constructivist, they provide a philosophically and pedagogically coherent base of theoretical and empirical insights which enhances pedagogic insights into information literacy learning. In particular, the active, iconic nature of discovery learning, the learner-centred nature of generative learning, the emphasis on authenticity and ownership in experiential learning, and the contextualised nature of situated cognition illuminate the assumptions underpinning information literacy learning and inform its design.

These particular theories and theorists have also been selected because their work has particular reference to the fact that this study is not a study of learning, but a study of learning based in using textualised *information*.. They illuminate and help to interpret the notion of empowering learners to construct knowledge from information.

The theories and theorists used are *representative.* The intention was, as stated, to 'mine' theory selectively (and inevitably eclectically) to inform the key characteristics of information literacy learning emerging from the analysis to date.

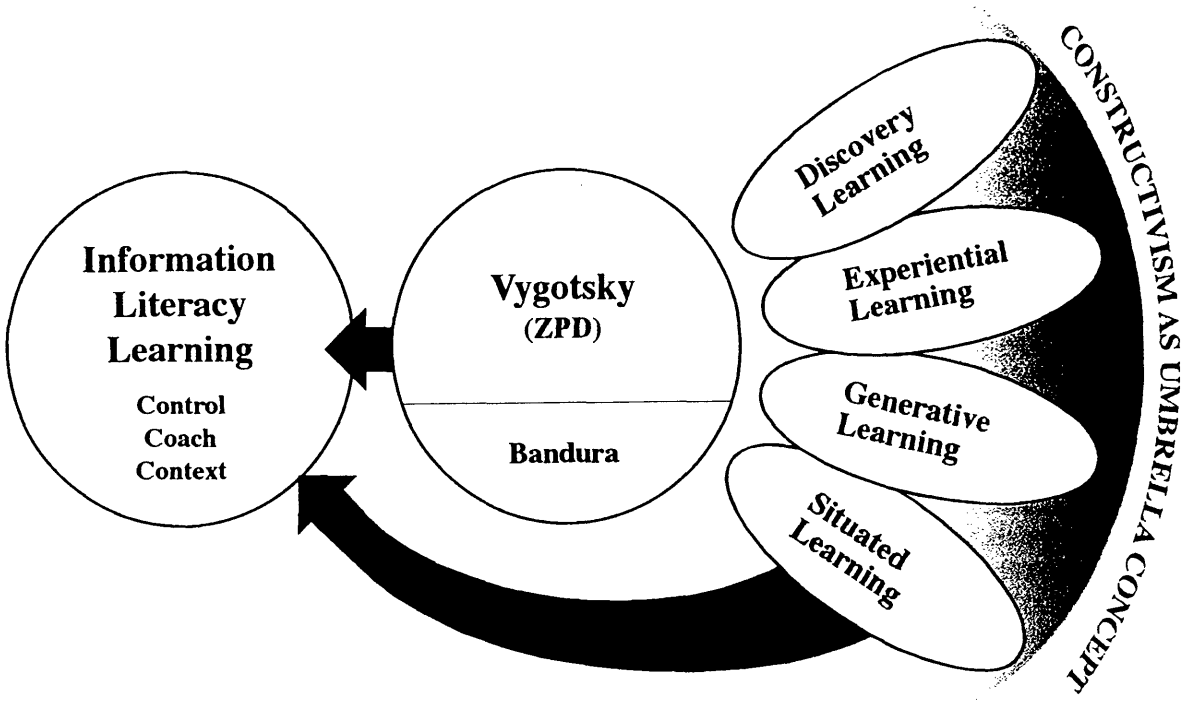


**Fig 2: Theories/ models of learning contributing to information literacy learning**

This suggests that information literacy learning derives from resource-based and technology-based learning and leads to information literacy. Information literacy learning is not a theory of learning, but it shares a number of characteristics with, and derives insights from, theories and models like Bruner's discovery learning (1966), Vygotsky's sociocultural theory (1978), Wittrock's generative theory (1974; 1977; 1991), experiential learning (Boud, Cohen, & Walker, 1993; Kolb, 1984; Rogers, 1983) and situated cognition (Brown, Collins, & Duiguid, 1989). These share with information literacy learning a central focus on the empowerment of learners, on learning as a process and on the centrality of the learner in the process. They acknowledge the contextualised nature of learning, and the fact that this context is both external (social, school, classroom, curriculum) and internal (learners' needs, purposes, efficacy, attributions).

> *Cognition is a constructive/ reconstructive process rather than a discovery/ retrieval process. That is, cognition is the creation and recreation of knowledge rather than the discovery or retrieval of knowledge. Humans construct knowledge though mental interaction with the physical and social world, as opposed to merely retrieving knowledge from that world* (West, Farmer, & Wolff, 1991, p.11).

A constructivist pedagogy of information literacy learning must acknowledge this generative, interpretative, transformative aspect if it is to transcend the limitations of the library-centred model. It also needs to overcome what Brookfield refers to as "a rhetoric of empowerment" (1993, p. 23) and the hyperbolic claims of 'technoromanticists' (cited, for example, by Healy, 1998). These theories and models offer insights which are specifically relevant to the *design* of information literacy learning.

## Discovery learning

Discovery learning is defined by Lefrancois as "the learning that takes place when students are not presented with subject matter in its final form but rather are required to

organize it themselves" (1994, p. 158). He sees Bruner's thinking as "based on the same fundamental belief" as constructivist thinking, that we discover our own meanings, make up their own versions of reality (ibid., p. 158).

Many of Bruner's ideas anticipated the central tenets of constructivism and constructivist information literacy learning because "Bruner argued that the teacher's role must be to create situations in which students can learn on their own, rather than to provide prepackaged information to students" (Slavin, 1991, p. 193).

> *We teach a subject not to produce little living libraries on that subject, but rather to get a student to think... for himself, to consider matters as an historian does, to take part in the process of knowledge getting. Knowing is a process, not a product* (Bruner, 1965, p. 72).

Bruner sees good problems as the chief vehicle for good curricula (1972, p. 125). He emphasises the issue of student ownership of the learning, and the need to "share the process of education with the learner" (ibid., p. 132). Noting the importance of "problem-finding", he adds "(l)et the skills of problem solving be given a chance to develop on problems that have an inherent passion..." (ibid., p. 131).

Like Vygotsky, Bruner describes the teacher's role as providing the scaffolding to guide the learner through the process (1974; 1972). Mercer and Fisher describe scaffolding as "the kind and quality of cognitive support which an adult can provide for a child's learning" and "(a)s such, it clearly relates to the concept of the zone of proximal development" (1992, p. 342). They suggest that "(t)eachers also seem to find the concept very appealing, perhaps because it resonates with their own intuitive conceptions of what it means to intervene successfully in children's learning" (ibid., p. 342).

Bruner anticipates much of the current emphasis on the affective dimensions of learning and metalearning strategies in emphasising "role of intention and goal directedness in learning and acquisition of knowledge and the conversion of skill into the management of one's own enterprises" (1972, p. 133). His emphasis on competence as self-rewarding echoes current concerns for self-efficacy (ibid., p. 93) He is one of the first theorists before Bereiter and Scardamalia (1985) to emphasise the value of learning how to condense information in transforming information into knowledge (op. cit., p. 95).

Bruner's discovery is not random exploration as it is often interpreted in current usage. As Lefrancois suggests, it hinges on the discovery of "relationships that exist among items of information"; "discovery is the formation of categories... defined in terms of relationships." (1994, p. 158). Bruner insists on learning as "an apparatus for processing knowledge about nature rather than a collection of facts that can be got out of a handbook" (1972, p. 124). Clark says that Bruner "identified the need for teaching the structure of knowledge and insisted that students could be taught the structure of a subject, ie, its fundamental concepts, in some form, at any age." (1992, p. 37). Novak and Gowin place Ausubel's reception learning and guided discovery learning on a continuum toward autonomous discovery learning, acknowledging the need for students to be *guided* to use strategies like their 'Vee' to see the "nature of the knowledge" in the subject discipline and develop a heuristic perspective (1984, pp. 8, 57; see also, Lefrancois, 1994, p. 169). Their strategies for sorting, categorising and mapping knowledge resemble Bruner's work on concept attainment (Bruner, Goodnow, & Austin, 1956). Bruner contributes insights into the context, control and coaching characteristics of constructivist information literacy learning by stressing the centrality of personal relevance and of subject discipline knowledge and control of the learning by the learner, achieved through teacher guidance. Bruner also provides insights into the area of iconic learning. His views anticipate Zuboff's (1988) work on informating (the intellective, essentially iconic skill of reconstructing a process from abstracted information).

The vocabulary has changed, but Bruner's emphasis on *seeing* conceptual wholes and relationships, on discovering new interrelationships and patterns is a contemporary one. It is precisely this emphasis that is so often lacking from current interpretations of 'inquiry' learning.

## Generative learning

The essential difference between early non-constructivist resource-based learning and the suggested model of constructivist information literacy learning lies in their different interpretations of what it means to 'use' information. The theory that contributes significantly to this key aspect of information literacy is Wittrock's model of generative learning and teaching (1974; 1977; 1988; 1991). Wittrock calls it "A cognitive model of human learning with understanding...", a "shift... toward reinstating the learner, and his cognitive states and information processing strategies" (1974, p.87). He explains that:

> *As different from elaborations, which are comments and explanations given by teachers, generations are mental activities performed by learners, usually upon request by the teacher* (1991, p. 83).

As such, guided by the teacher, students use "summaries, pictures, headings, inferences, evaluations, underlinings, metaphors, analogies, diagrams and discussions" (ibid., p. 83). By moulding and shaping the information "(t)he learners actively generate relations between their experience and the text they read...," and the "heuristic of generating one's own interpretation or representation facilitates memory and comprehension" (ibid., p. 83).

While the objective in information literacy learning is comprehension rather than memory, Wittrock's model highlights that the learner's 'generations' make the difference between knowledge telling and knowledge transforming (Bereiter & Scardamalia, 1989).

## Experiential learning

Carl Rogers is generally seen as one of the founders of experiential learning, although the term was first integrated into a theory by David Kolb (1984). Like 'discovery' learning, the current everyday use of the term 'experiential' learning by teachers may do a disservice to the original concepts. If experiential learning is seen as learning from experience, it can lead to an experiential version of 'sending them to the library to look it up', learning 'by osmosis'. If experience is used as an information resource, students need to know how to learn from it.

> *The only way we can be assured of that help is to assist our youth to learn deeply and broadly, and above all, to learn how to learn* (Rogers, 1983, p.1).

Rogers recognises the contribution of resources, including "human resources" to experiential learning, and the role of teacher as facilitator of learning experiences:

> *Instead of spending great blocks of time organizing lesson plans and lectures, facilitative teachers concentrate on providing all kinds of resources that can give students experiential learning relevant to the students' needs. These teachers also concentrate on making such resources clearly available by thinking through and simplifying the practical; and psychological steps the student must go through in order to use the resources* (ibid., p. 48).

While Rogers' work on personal growth and development is well known, his ideas for enhancing the feelings of control and self-worth *as learners* are less so. They anticipate the self-efficacy and self-regulation dimensions seen as germane to learner control of constructivist information literacy learning. Rogers places particular emphasis on cooperative planning between teacher and learner to establish learning goals, and sees the need for more time to achieve meaningful project learning (ibid. , p. 210).

Whitaker (1995, p. 5) cites Boud's five propositions about learning from experience:

- Experience is the foundation of, and the stimulus for, learning.
- Learners actively construct their experience.
- Learning is a holistic process
- Learning is socially and culturally constructed.
- Learning is influenced by the social and emotional context in which it occurs.

While Kolb (1984) is best known for his problem-solving cycle and its use with adult learners, his work addresses all five features, and anticipates much of the current emphasis on authenticity in situated learning. In terms of information literacy, his emphasis on the need to create learning environments and opportunities within them for students to use experience as a resource, a basis for observation and reflection, is significant. It also anticipates situated learning. Like Rogers, he emphasises the centrality of the learner in the process, the need for a heuristic, problem-solving approach and the need for 'learning how to learn', knowledge

The multi-modal availability of information in the information age creates the need for learners to understand their strengths as learners, but also the how particular technologies mediate learning (Rushkoff, 1996). It becomes crucial to reconceptualise experiential learning (and Vygotsky's ZPD) in the light of the 'information age', and the extent to which the experiential reality of many children is defined as much by their mediated experience of the real world (through television, multimedia computer and CD games) as actual experience in the real world. Computers and information technology are not, so far as children are concerned, the medium for the message. They are both - a dimension of affective and cognitive experience critical to any consideration of experiential learning, and integral to information literacy learning .

Brew echoes Bruner, saying, "we begin to see the way in which traditional ways of learning and conventional views of knowledge can get in the way of our coming to know; can be a way, again paradoxically, of preventing us from knowing" (1993, p. 89). Boud, Cohen and Walker emphasise that learning is not information processing in the head. It "involves much more than an interaction with an extant body of knowledge" (1993, p. 1).

Knowing ourselves and knowing ourselves *as learners* are prerequisites for learning from experience, whether that experience is mediated through text, electronic media, people, or activity. Like Rogers, Brew sees reading books as "a special way of learning from experience" (ibid., p. 87), but she points out that learning from experience is more than just fact accumulation. Notions that accumulated knowledge or accumulated experiences build wisdom are merely assumptions. Real learning involves what she calls "inner knowing" (ibid., p. 89). Reflection and metacognition are keys to "inner knowing".

Boud and other authors currently working in the field of experiential learning emphasise the importance of reflection (for example, Whitaker, 1995, p.11). Andresen points out that what Schon called 'reflection-in-action' is integral to adult professional practice saying, "There is a fundamental tension between becoming fully immersed in an event and standing back to witness our own actions" (1992, p. 67). How much more so for inexperienced young learners to reflect on themselves as learners as well as on the potential knowledge embedded in a learning event?

> *...when the event is poorly designed - or has not been planned specifically for learning... learners have to develop their own strategies to incorporate reflection, often covertly, during the activity* (Criticos, 1993, p. 167).

While their work, as with much current writing on experiential learning, relates to adult learning, it highlights the role of *reflection* in establishing control and ownership of the learning. Reflection is integral to the constructivist information literacy learning process, and it must include collaborative student and teacher evaluation of all dimensions of the learning experience. Laurillard says:

> *Everyday knowledge is located in our experience of the world. Academic knowledge is located in our experience of our experience of the world* (1993, p. 26).

As suggested above, an increasing amount of the young learner's everyday knowledge is located in experience *of experience* of the world through electronic media. It acknowledges the changing nature of the child's experience, and the need to reconceptualise many of the valuable earlier precepts of experiential learning.

Bamberger, working with children aged 6-14, echoes Zuboff's 'informating' concept, commenting that, "in this way the computer functions as a kind of mediator, a 'transitional object' between sensory action know-how and symbolic know-how" (1991, p. 39).

The relationship between technology as mediator, thought and language (verbal, visual, iconic, kinaesthetic, imaginative) constitutes an area of experience in which teachers are relative novices. Informating depends on what we do with what the technology does for us - a new and barely explored dimension of experience which seems to be critical to information literacy learning *and* experiential learning.

The notion of the student's prior *experience* is wider than that of prior knowledge; it includes prior experience as a learner. It also includes wide experience of *mediated* reality. The key to being a teacher in an information literacy learning environment is, surely, to work heuristically and reflectively with the learner's experience. Laurillard (1993) points out, the relevance of academic knowledge is often not immediately apparent to students; it needs to be interpreted through what Erickson and MacKinnon call 'reflective conversations' (1991, p. 18). They use Shulman's notion of 'pedagogical content knowledge' to suggest another dimension to experience - the teacher uses her/his experience "of both the subject matter itself and possible student interpretations of this content" to guide this 'noticing' and 'intervening' and these 'reflective conversations' (ibid., p. 31).

## Situated learning

Situated learning is also critically concerned with the learner's experience. While it is not synonymous with constructivism, it is a key plank in constructivist approaches and pedagogy (for example, Duffy & Cunningham, 1996). As Brown, Collins and Duguid point out, drawing on the work of Suchman, Lave, Schoenfeld and others, "knowledge is situated and is partly a product of the activity, context and culture in which it is used" (1989). McLellan points out that "this view of knowledge as *situated* affects our understanding of learning" and this in turn has "very important implications for the design of instruction, including the design of technology-based instruction" (1993, p. 5) . This is, surely, no less so for information literacy learning which increasingly involves technology-based learning.

Constructivism has been depicted as an umbrella of related approaches and concepts (for example, Duffy & Cunningham, 1996). Within this umbrella situated learning itself provides an umbrella for several theories and approaches which provide valuable insights into designing learner-centred learning. This is useful because, without concrete exemplars, 'learner-centred', 'child-centred' 'student-centred' can become emotionally appealing but pedagogically fuzzy slogans or cliches.

McLellan (1994, p. 7) lists the key components of the situated learning model as *apprenticeship, collaboration, reflection, coaching, multiple practice* and *articulation of learning skills*. As such it is consistent with the information literacy learning elements of 'context, control and coaching', and extends pedagogic insight into their role in information literacy learning.

Brown, Collins and Duguid (1989) drew attention to Jean Lave's work, focussing attention on the notion of novice and expert and exploring their roles in "cognitive apprenticeship". The notion of cognitive apprenticeship is particularly valuable in information literacy learning, because, as empirical studies have shown, without expert guidance, novices flounder and reduce what has been established as a complex and multi-faceted kind of learning to a formulaic recipe for manual or electronic fact pastiches.

Brown and Duguid (1993) credit Lave for inverting established perspectives on learning and looking at learning not, as is conventional, from the pedagogical perspective, but instead from the learner's perspective (ibid., p. 10). They suggest that "reconceptualizing learning, as situated approaches have done, requires also the reconceptualizing of

prevalent notions of teaching, instruction, the learner, subject matter, technology and system..." and depict the shift as:

- instruction vs learning;
- explicit vs implicit;
- individual vs social systems;
- narrowly construed vs systems broadly construed (ibid., p. 10).

They point out that, trying to 'operationalise' situated learning involves fundamental shifts in thinking. One of these is the shift from instruction to learning. They say "Where 'situated learning' talks of *learning*, questions about educational technology tend to be framed around teaching and instruction" (ibid., p. 10; see also, Jonassen & Reeves, 1996, p. 693). There is no less a paradigm shift for 'first generation' RBL and 'first generation' instructional design. This study of constructivist information literacy accepts the premise that "if you want to understand learning and what is learned in any interaction, you have to investigate from the point of view of that learner" (ibid., p. 10).

Brown and Duguid also reinforce the centrality of the social nature of constructivist information literacy learning by comparison with the individualised nature of traditional library-centred research. They discuss Lave and Wenger's (1991) 'communities of practice' and suggest that "quite complex practices can be learned effectively and easily where the social context is evident and supportive", and that technological design should "provide the glue for this social periphery" (1993, p. 12). They highlight the significance of 'context':

> *The system in the conventionally narrow sense of the term needs to be connected to this broader system - to the material, technological, and social system that surrounds the practice of which the individual technology forms just one part* (ibid., p. 13).

Laurillard sees situated learning as an "interesting and powerful idea" (1993, p. 22), but claims that it does not "illuminate the essential difference between academic knowledge and everyday knowledge":

> *The whole point about articulated knowledge is that being articulated it is known through exposition, argument, interpretation; it is known through reflection on experience and represents therefore a second-order experience of the world* .

If situated learning is to be more than a metaphor in designing constructivist information literacy learning, Laurillard's caution needs to be addressed. It is similar to the concern expressed previously about the ambivalent position of 'articulated knowledge' in the radical constructivist perspective, and it is germane to the interpretation of coaching. Brown and Duguid (op cit., p. 13) refer to Lave and Wenger's notion of 'legitimate peripheral participation' (LPP) and warn against misleading oversimplification. Lave and Wenger say:

> *Learning viewed as situated activity has as its central defining characteristic a process that we call legitimate peripheral participation. By this we mean to draw attention to the point that learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community* (1991, p. 29).

This reinforces the importance of contextualised mediation in constructivist information literacy learning - all the more so in complex information- and technology-enhanced learning environments. Laurillard says "(t)eaching as mediating learning involves constructing the environments which afford the learning of descriptions of the world" and that "(s)tudents have to learn to handle the representation system as well as the ideas they represent." She emphasises the reflective dimension as integral to contemporary definitions of experiential learning (1993, pp. 26 - 27; see also Rushkoff, 1996).

Mediation is currently largely a human dialectical function, as implied in Jonassen's depiction of constructivism as 'conversational' (1995, p. 61). However, the CFH 'criss-crossing the landscape' hypertext designs suggest that, increasingly, mediation will be an interactive dialogic function built into the design of the learning environment, the resources and the software (Spiro et al., 1995).

Jonassen cites his own work, and that of Cunningham, Bednar, and Duffy, in noting that:

> *Considerable interest has been paid recently to applications of constructivism and the design of constructivistic learning environments... Constructivism proposes that learning environments should support multiple perspectives or interpretations of reality, knowledge construction, context-rich, experience-based activities* (1991, p. 28).

Dede (1995, p. 46) says, "Thus technology-enhanced constructivist learning currently focuses on how representations and applications can mediate interactions among learners and natural or social phenomena", but legitimate peripheral participation, distributed intelligence and cognitive apprenticeship define a much more complex learning environment than learning mediated by technology alone.

It was suggested that the design of the learning environment will determine the type and quality of student learning. Jonassen sees technology as integral to the cognitive apprenticeships of the 21st Century, connecting "communities of learners within schools, with communities of practitioners in the real world" (1995, p. 60). Candy quotes a good illustration of legitimate peripheral participation, distributed intelligence and cognitive apprenticeship mediation in situated learning:

> *Furthermore, important aspects of that knowledge are built into tools. These aspects of knowledge, although not needed by the people who actually pilot the ship, are needed by cartographers and gyrocompass builders. Thus, there is a further sharing of knowledge - with tools, and with the builders of tools, who are not present during piloting, but who are part of the total knowledge system required for successful piloting* (1991, p. 306).

Gardner points out that:

> *Apprenticeships embed the learning of skills in a social and functional context, with well-defined stages of mastery. In our view, the apprenticeship model, where students receive frequent and informal feedback on their progress in highly contextualized settings, holds much promise educationally* (1993, p. 107).

Cognitive apprenticeship emphasises the need to explain *cognitive* processes so that learners not only understand how, but *why* through frequent 'reflective conversations' (Erickson & MacKinnon, 1991, p. 18).

The design of New Zealand's national 12-week information literacy inservice course uses the New Zealand framework (Gawith, 1986; 1998) and provides for collaborative student/ teacher stage-by-stage planning and evaluation, embodying Gardner's view of cognitive apprenticeship. Where it coincides with teachers' existing beliefs and values, it has lasting impact. Where it does not, and where teachers themselves are novices in the coaching strategies implicit in student-centred constructivist learning, the cognitive apprenticeship model is not enough, in our experience, to engender the required ontological and epistemological paradigm shift. Pedagogical strategies are retained, but these are grafted onto existing paradigms

Cognitive apprenticeship used explicitly as a pedagogy does, nevertheless, assist in sharpening the focus on the problem, and on the difficulty of integrating 'paradigm shifting' part-time inservice courses into the over-full, stressful reality of teaching. Similarly, this is likely to influence the introduction of the new framework. The context for these teachers is authentic, but authenticity without space and time for reflection may be counter-productive of significant learning.

Candy says:

> *If educators seek to help learners to be able to learn outside of formal settings, part of the answer is probably to make the formal setting as much like the natural one as possible... trying to make the act of learning itself comparable to the learning undertaken in everyday settings* (1991, p. 144).

Bransford and the CTGV design group have been explicit about doing this in the design of their Jasper videodisc problem-based learning situations and talk about "how procedures that help students experience the usefulness of information facilitate access" (to content knowledge) (see also, Bransford, Vye, Kinzer, & Risko, 1990, p. 391; Young & Kulikowich, 1992). Authentic task design is seen as a key point in constructivist learning design. Candy illustrates the dimensions of authenticity:

> *(T)he self directed learner is bounded by the nature of knowledge in the field and by the fact that at least some parts of the required knowledge are embedded in the detail of "authentic practice"* (1991, p. 307).

To be situated in the context of the curriculum and, simultaneously, interesting and authentic to learners may, as Laurillard suggests, be a contradiction in terms (1993).

Young says that 'authentic tasks' enable students to immerse themselves in the culture of an academic domain (1993, p. 43). The New Zealand course suggests that lack of time for reflection compromises authentic learning for teachers. Similarly, students need ample time and opportunities for reflection which the current New Zealand national school curriculum may not give them. 'Anchoring' the learning in contexts derived from the curriculum but designed to contextualise a problem in a way that is interesting to a young learner is integral to mediating learning. Mediation to create authenticity is a function of:

- the design of the environment;
- the design of learning conditions, including time;
- the nature of the technology and software;
- the nature of the learning task and purpose;
- the 'reflective conversations' which focus strategy use.

*Mediation* is not a fashionable synonym for teaching as facilitation has become. It is integral to the *design* of an authentic learning environment for a *community* of learners with built-in time and opportunities for *collaborative reflection* and a participative role for the teacher in the process. Few New Zealand teachers, in our experience, are able to do this without *themselves* being part of a learning community where more experienced tutors use cognitive apprenticeship as a strategy to mediate 'reflective conversations' in which they participate, as part of the course design, through site-based school discussion groups, and national audioconferences involving other school site groups, course staff and 'experts' in the field.

Lave and Wenger's view of legitimate peripheral participation is significant in this regard:

> *Learning viewed as situated activity has as its central defining characteristic a process that we call legitimate peripheral participation. By this we mean to draw attention to the point that learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community* (1991, p. 29).

This relates to the point made previously, that New Zealand students and teachers alike are relative novices in the information society and in sophisticated technology-enhanced learning environments. The information society and its sociocultural practices are, largely, driven by the commodification of information (Cronin, 1983). Pea and Brown comment that "the need for responsiveness has become salient as computational media radically reshape the frontiers of individual and social action, and as educational achievement fails to translate into effective use of knowledge" (1991, p. 11)

Reeves (1992, p. 48) suggests that claims for 'learning environments of unparalleled richness' 'border on hyperbole' and imply that learning is automatically generated, a notion that Beynon calls technoromanticism (1993, p.23).

Wenger's comment that "(i)n contrast with learning as internalization, learning as increasing participation in communities of practitioners concerns the whole person acting in the world" can be extended to those acting in the world of information, the information society (Lave & Wenger, 1991, p. 49). It illustrates the need for a new approach to designing constructivist information literacy learning, an approach that essentially recognises its *learner-centred,* situated, contextualised, mediated nature. Harley says:

> *From the perspective of pedagogy in the classroom, situated learning focuses educators' attention on trying to understand the "fusion point" between a student's previously acquired personal knowledge - created from the historicity of personal experience- and new knowledge substantively defined by the collective agreement of experienced practitioners in a knowledge community* (1993, p. 46).

Winn says, "The more I read about situated learning and constructivism, the harder I find it to define a role for instructional design" (1994, p. 13). In contrast, the more information literacy learning is embedded in the school curriculum, the more the *need* for constructivist design principles like anchored instruction becomes evident; design principles which acknowledge these dimensions of situatedness in a rich and complex information environment and which acknowledge the reality of the teacher's life and task.

Tripp asks whether *stories* like the Jasper videodiscs are situated learning. He questions the power of a well-designed learning environment and software to mediate student thinking and learning:

> *A simulation of the world is not the world... I do not believe that what they say they are doing is situated learning. Second, I do not think they are teaching problem solving.... The Jasper videos are not in the world. They are stories which have verisimilitude* (1993, p. 75).

Rushkoff's (1996) point about the media-mediated reality of screenagers also needs to be considered in relation to this comment. Ultimately, Tripp claims, all learning is situated (op. cit., p. 75). This is true to an extent, just as it true that all knowledge is constructed, and all learning is based in experience, but self-evidence does not negate value. The value of the concept of situated learning lies in the focus it provides on learner-centred problem-solving *pedagogy* where students and teachers work together to interpret representations of real world problems (Laurillard, 1993, p. 25). "It is not a question of situated or not, but rather *how* it is situated" (Cognition and Technology Group at Vanderbilt, 1994b, p. 29). The design of the learning - including the design of teachers' and learners' roles - appears critical to the pedagogical application of situated learning.

Young (1993, p. 43) sees four broad tasks in designing situated learning: selecting situations, providing scaffolding, determining and supporting the role of the teacher, and assessing learning. He stresses the importance of providing meaning, affording transfer and providing the anchor for cross-curricular investigation.

> *Traditional classroom activities simply do not afford students an opportunity to tune their attention in the same way as when students are engaged with complex realistic problem-solving environments... the students must be active and generative with the environment..., as well as interact with the environment across a significant period of time...* (Young & Kulikowich, 1992, p.2).

**Summary**: If constructivist information literacy learning is characterised by student *control* of learning, through teacher *coaching* and mediation of *context* in curriculum learning, there exists a rich heritage of theory and pedagogy to inform the design of such learning. While discovery, generative, experiential and situated learning theories have been drawn on selectively, their common philosophical commitment to empowering learners reinforces the central tenets of the proposed CILL Framework - student control of contextualised information literacy learning mediated through coaching.

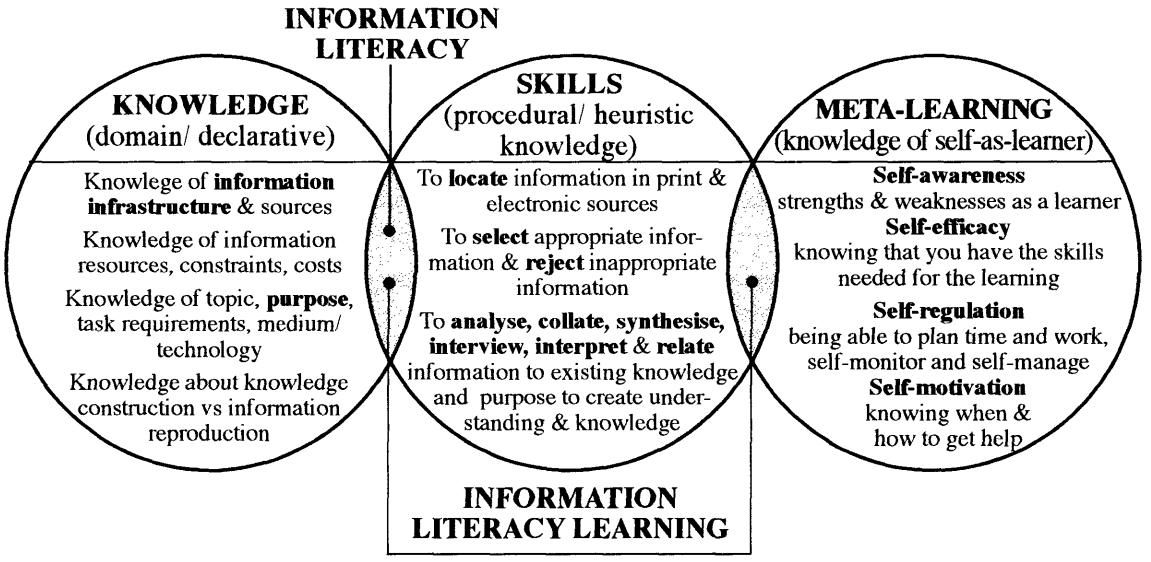


**Fig 3: Towards a model of information literacy learning**

This model suggests that information literacy (represented in the first 2 circles) is an interaction of knowledge and skills, as determined in the literature reviewed.

It then suggests that a constructivist approach to information literacy learning superimposes the dimension of control which includes aspects of self-regulation, self-efficacy, motivation, metacognitive and metalearning strategies.

Underpinning this constructivist model of information literacy learning are the three inter-related and interdependent pedagogical assumptions, here related to students, and three parallel and implicit assumptions here related to teachers.

### Assumption 1

That students can control their own learning;

That teachers are able to design and plan information literacy learning opportunities and environments which promote student control of learning **(control).**

### Assumption 2

That most students will only learn to control their learning if this learning is coached/ mediated;

That teachers themselves know the information literacy skills and strategies needed for this type of learning and are able to coach students where necessary **(coach).**

### Assumption 3

That constructivist information literacy learning can be contextualised within the context of the [New Zealand] curriculum and classroom programmes;

That teachers will need to employ teaching models which integrate information literacy learning opportunities into curricular contexts in relation to individual student learning needs and abilities, and within normal classroom constraints **(context).**

## The assumptions

While the need to teach children to become self-directed learners is frequently acknowledged (for example, Candy, 1993, p. 68), some 22 earlier RBL studies established the futility of giving students independence without the self-regulatory skills and learning strategies required for effective control of learning (summarised by Heeks, 1989; Irving, 1983; Paris , Lipson, & Wixson, 1983; Rogers, 1994). Several of these studies illustrate what Resnick (1989a, p. 2) points out - that children cannot be left to discover everything for themselves (see also Best, Heyes, & Taylor, 1988; Brake, 1985; Carter, & Monaco, 1987; Griffin, 1983; Heeks, 1988; Irving, 1990b; Kinnell & Pains-Lewins, 1988; Lincoln, 1987; Norris & Sanger, 1984; Rudduck & Hopkins, 1984; Thomson & Meek, 1985).

There is also research evidence to suggest that, in this area at least, teachers are not the 'skilled practitioners' to which Collins, Brown ans Newman refer (1989; see also Avann, 1984 Beswick, 1982; Biggs, 1991; Brake, 1980; 1984; Bruce, 1996b; 1989, p. 45; Heather, 1984a; Hertfordshire Library Services, 1986; Hounsell & Martin, 1983; 1983; 1981; 1983; Irving & Snape, 1979; Juchau, 1984; Lincoln, 1987). Farnham-Diggory (1992, p. 81) comments that teachers seldom demonstrate how they learned to learn, while studies done by Best, Abbott and Taylor (1990) Malley (1984) Cowley (1990), Squirrell, Gilroy, Jones and Rudduck (1990); Jones and Rudduck (1990) illustrate a culture of dependency in teacher education; teachers who, themselves, lack the skills for self-directed learning, let alone an appreciation of how to design the type of learning which encourages students to develop the required organisational and cognitive skills for resource-based learning. What teachers gave students was independence, but little help in developing the skills for student-centred, self-regulated resource-based learning (see, in particular, Carter & Monaco, 1987; Heeks, 1988; 1989; Irving, 1990a; Irving, 1990b; Norris & Sanger, 1984; Rudduck & Hopkins, 1984; Sanger, 1989; Thomson & Meek, 1985; Valentine & Nelson, 1988).

The decontextualised study skills instruction programmes of the 70s and 80s, similarly, did not appear to enhance the quality of student learning, their motivation, or the transfer of skills (for example, Costa, 1984, p. 58; Gibbs, 1977; 1987, p. 156; Martin, 1987; Pintrich & Schrauben, 1992, p. 142; 1987; Tabberer & Allman, 1983). Biggs calls these decontextualised study skills courses an 'academic placebo' (1991, p. 109). In part, this may be because many presuppose a cognitivist, information-processing model of learning. Learning is seen as something that happens purely in the head, underestimating the centrality of the learner in the process, in terms of motivation, attitude, view of the task, self-efficacy, expectations and ability to transfer skills without instruction (Kirby, 1988). In his analysis of courses which achieved a degree of success in terms of transfer of skills, Biggs identifies metacognition as the key ingredient (1987a, p. 109). He cites Wagner and Sternberg's conclusion that "(e)mphasis on metacognitive training does result in some degree of durability and transfer", and relates students' 'deep-oriented' approach to learning to motivation and strategy orientation (1987a; see also Johnson, 1990; Nisbet & Shucksmith, 1986).

As Zimmerman and Martinez-Pons suggest, early studies of learning failed to see learner control of learning, context for learning and purpose/ motivation for learning as central to learning (1992, p. 191). Laboratory studies often imply that cognitive skills are synonymous with learning skills, and that what *can* be used *is* used (Royer, Cisero, & Carlo, 1993, p. 202). Decontextualised training in cognitive strategies does not ensure that skills will be used and achieve transfer (Pintrich & Schrauben, 1992, pp. 142, 149; Zimmerman & Martinez-Pons, 1992, p. 185).

The centrality of the learner (motivation, concept of learning, ability to self-regulate and use metacognitive and other learning strategies) and the contextualisation of learning which are integral to information literacy learning are similarly not recognised in 'information processing' theories. The limitations of the information processing model in this regard are widely acknowledged (Bandura, 1986, p. 107; Bjorklund, 1990 p. 93; Bruer, 1993, p. 32; Cervone, 1993, p. 58; Johnson-Laird, 1983; Laurillard, 1987, p. 20;

McGuinness, 1993, p. 121; Metcalfe & Shimamura, 1994, p. 7; Neisser, 1987, p. 1; Paris et al., 1983, p. 35; Paris & Oka, 1986, p. 27; Sternberg, 1987, p. 50).

While recent cognitive theory embraces a broader and more learner-centred view of learning (McGuinness, 1993), many cognitive theorists still depict intelligence as relatively immutable (for example, Cervone, 1993; Thomas & Rohwer, 1993). In contrast, Sternberg (1987; 1998) suggests, as does Vygotsky, that intelligence is influenced by formal learning as a social, cultural, contextual process. Sternberg emphasises the interaction of internal and external worlds of the individual, and experience. These relate closely to the characteristics outlined above; that students need to learn to control learning, in curricular contexts, guided or coached by teachers. He points out that theorists have tended to specialise in one or other of these three aspects. Like Vygotsky's work (discussed below), Sternberg's triarchic theory has the breadth to illuminate and give coherence to a constructivist approach to information literacy learning. Similarly Biggs' theory relates 'presage, process and product' to the internal, external and experiential dimensions of learning and emphasises the relationship between the 'control, coach, context' assumptions, and the centrality of the learner in the learning (1987b; 1991; Biggs & Telfer, 1987)

Gardner, likewise, in his theory of multiple intelligences emphasises student choice of preferred learning approach, but also advocates monitoring and teacher guidance to ensure that students build skills in a repertoire of 'intelligences' (Gardner & Boix-Mansilla, 1994). By learning to recognise their stronger and weaker intelligences, they develop self-efficacy. The Key School project demonstrates, in practice, that students are being guided to control their learning, and to regard their intelligences as tools for learning; something they can shape and develop (Gardner & Hatch, 1990; Hoerr, 1994).

McGuinness outlines the influence of 30 years of research in the information processing paradigm on the teaching of thinking, and suggests that the constructivist paradigm is evidenced by educational theorists (1993). Information literacy fits comfortably into the constructivist paradigm as defined by Cobb:

> *A constructivist viewpoint in education considers the learner as an active purveyor of meaning and sees instruction as negotiation between two sets of conceptual structures - the teacher's and the learner's* (cited in McGuinness, 1993, p. 310).

Schunk highlights the type of learning leading to information literacy:

> *Current learning research explores the role of student perceptions in the acquisition, retention and use of knowledge. A particularly active area of research is concerned with teaching students to use learning strategies, or systematic cognitive plans that assist the acquisition of information and task performance... Researchers are showing that learning is a complex process affected by personal and contextual variables and that students' perceptions of themselves, teachers and peers are influential during learning* (1992, p. 8).

Pintrich and Schrauben reinforce the centrality of the learner to the learning in discussing three aspects of motivation: "(a) what activities they choose to become involved in, (b) the level of intensity in which they engage in an activity, and their persistence at the activity (1992, p. 150). They describe "cognitive engagement as motivated", characteristics central to the 'control' aspect of successful information literacy learning:

> *...students' willingness to persist in the face of a difficult academic task by monitoring their performance, and, if needed, regulating their behavior by trying different problem solving or cognitive strategies to complete the task reflects both motivation and cognition...* (ibid., p. 151).

In broad terms, therefore, these assumptions provide a solid underpinning to information literacy learning, but how do they stand up to individual scrutiny?

## Assumption 1: Students can control their own learning

The assumption that students can control their learning is supported by a number of different theories, and embraces diverse aspects including self-efficacy, attributions, motivation, planning and monitoring, self-regulation and self-direction. More recently theorists have linked control of learning with metacognition. Pintrich and Schrauben (1992, p. 152) and Schunk and Meece (1992, p. 7) distinguish between motivational and cognitive dimensions of control. This is a helpful distinction in terms of the relationship between the three dimensions of control listed above, self-awareness, self-regulation and cognitive or strategic use of skills, or how students become active agents in constructing their own contextualised knowledge.

In this study self-efficacy, motivation and planning are seen as prerequisites for self-regulation and self-direction of learning. These, in turn, are seen as prerequisites for a constructivist approach to information literacy learning.

**Bandura's social cognitive theory** presents a "model of triadic reciprocality in which behavior, cognitive and other personal factors all operate as interacting determinants of each other" (1986, p. 18). Like Vygotsky's theory, Bandura's theory anticipates a broad theory base of developments in 'control', and provides an integrative model which accommodates later developments in areas like metacognition and self-efficacy. Like Vygotsky, Bandura sees learning as social, and symbols as playing a key role:

> *Through symbols, people process and transform transient experience into internal models that serve as guides for future action* (ibid. , p. 18).

Bandura provides insights into what constitutes 'control'. The dimensions his theory embraces which are particularly relevant to information literacy learning include self-efficacy, motivation, goal-setting, the role of symbols, the influence of modelling, rehearsal and feedback, the social context for learning, self-regulation, and learning from electronic media (1982; 1986; 1989; 1981) Bandura's definition of learning, like Vygotsky's, supports the three underlying assumptions of information literacy learning. Learning is seen as the interaction between control, coaching and context variables; the result of interaction between learner and teacher or mediating agent:

> *Learning is largely an information-processing activity in which information about the structure of behavior and about environmental events is transformed into symbolic representations that serve as guides for action. In the social cognitive analysis of observational learning... modeling influences operate principally through their informative function. Providing a model of thought and action is one of the most effective ways to convey information about the rules for producing new behaviour* (1986, p. 51).

In the same way as Vygotsky's theory provides coherence between the diverse components subsumed under the umbrella of the information literacy process, Bandura's social cognitive theory provides coherence between the components of the concept 'control' which are often pursued by researchers as individual phenomena:

> *Although research has been conducted within various theoretical traditions, it is united in its emphasis on individuals' beliefs concerning their capabilities to exercise control over important aspects of their lives. The central hypothesis is that self-efficacy for learning cognitive skills is an important variable in understanding students' motivation for learning* (Schunk, 1989, p. 13).

Information literacy learning is not seen as synonymous with cognition - something that happens in the head alone. The learner's self and environment are integral to the learning. Self-efficacy is a key factor.

## Self-efficacy

Unlike behavioural theorists, Bandura regarded learning and performance as two separate events (Gredler, 1992, p. 308). Self-efficacy is a key determinant of both. Bandura defines it as "people's beliefs about their capabilities to exert control over events that affect their lives" and says:

> *Self-efficacy beliefs function as an important set of proximal determinants of human motivation, affect and action. They operate on action through motivational, cognitive and affective intervening processes* (1989, p. 1175).

Bandura links self-efficacy beliefs with outcome expectations (1982, p. 140) and, in turn, with motivation, goal-setting and self-regulation.

> *Students' beliefs in their efficacy for self-regulated learning affected their perceived self-efficacy for academic achievement, which in turn influenced the academic goals they set for themselves and their final achievement* (Zimmerman & Martinez-Pons, 1992, p. 663).

The early resource-based learning studies showed that many students had difficulty with goal setting (possibly because they could not visualise the process sufficiently clearly to set proximal goals); were poorly motivated, lacked perseverance, did not expect to achieve success and often attributed their lack of success to lack of ability, not lack of effort or skill. The New Zealand information process framework was devised to give students more control by breaking the learning into 'self-drive' stages. Bandura's theory suggests that students can learn to control their learning, but only if their judgments of self-efficacy support investment of effort and self-referent thought (1982, pp. 122 - 123). He emphasises the value of observation, learning through modelling, cognitive rehearsal, and self-monitoring and feedback (1986, pp. 47, 60, 67). He comments on the value of cognitive rehearsal:

> *Having people visualize themselves executing activities skillfully raises their perceived efficacy that they will be able to perform better* (ibid. , p. 62).

The complexity of the sub-processes in self-regulation explains why, although students *can* control learning, few do. These sub-processes include self-observation, self-monitoring and self-reactive influence, self-directedness and goal-setting, temporal proximity (of self-monitoring to change in behaviour), informativeness of feedback, motivational level, valence, focus on successes or failures and amenability to control (ibid., pp. 337 - 344).

Dembo and Gibson suggest that "teachers' sense of efficacy - the extent to which teachers believe they can affect student learning" is a significant influence (1985, p. 173). Information literacy learning is an area where, as discussed, teachers themselves lack expertise and, presumably, self-efficacy. Bandura also challenges the effectiveness of the school "as an agency for cultivating cognitive self-efficacy" and suggests that:

> ... *educational practices should be gauged not only by the skills and knowledge they impart for present use but also by what they do to children's beliefs about their capabilities which affects how they approach the future. Students who develop a strong sense of efficacy are well equipped to educate themselves when they have to rely on their own initiative* (1986, pp. 416 - 417).

Bandura's work foreshadowed subsequent work on motivation, planning, academic self-esteem and self-regulation. In short, self-esteem means "I am; I can" (Krupp, 1992, pp. 163 - 164) and, without self-efficacy, students are unlikely to have the motivation to say "I will" in information literacy learning (Schunk, 1981).

## Motivation

Weiner's attributional theory of motivation, like Bandura's theory, provides a backdrop for subsequent work on motivation. He analyses studies investigating perceived causes of student success and failure and describes how the components influence each other:

> *...outcomes determine general affective states, and general affective states influence outcome perceptions; attributions influence expectancy, and expectancies guide attributions...* (1986, p 241).

Weiner sees the need to link thought and action in motivational theory (1972, p. 91). He analyses numerous theories of motivation including psycholanalytic, drive, field, achievement, attribution and construct theory, concluding that:

> *The primary perceived causes of achievement-related outcomes are ability and effort, but the difficulty of the task, luck, mood, and help or hindrance from others are included among the other possible explanations of success and failure* (1979, p. 404).

Weiner discusses three causal dimensions of student success and failure - stability, locus, and control and suggests that they link with expectancy change, esteem-related emotions and interpersonal judgments (1979, p. 3). Gredler notes, "specific classroom procedures for the implementation of attribution theory in the classroom are yet to be developed" (1992, p. 386). Nevertheless, Weiner's theory is central to the information literacy 'control' assumption in describing, firstly, how the search for understanding is fundamental, secondly, how motivation is influenced by expectations, self-esteem and perceived causes of outcomes (Gredler, 1992, p. 386; Weiner, 1979, p. 3), and, thirdly, the extent to which teachers' attributions influence student attributions (Weiner, 1979, p. 6). Students who are "failure-oriented" or "helpless" supply attributions (attributing failure to lack of ability rather than lack of effort), while "mastery-oriented" students do not do so to the same degree (ibid., p. 6). If expectations of success and failure are based on students' perceived level of ability in relation to the perceived difficulty of the task, this signals implications for the teacher's role in influencing student expectations.

Feedback is central in Bandura's theory (1986). Cameron and Pierce discuss social rewards and verbal praise in intrinsic motivation, and cite Deci and Ryan's cognitive evaluation theory which emphasises that "rewards promised to persons for engaging in a task without a performance criterion... are controlling and decrease intrinsic motivation" (1994, p. 370). These insights are germane to the 'control' aspect of information literacy learning. The existing New Zealand framework provides the structure for teachers to work with students to provide performance criteria for each stage, but course moderation records show that this is seldom done spontaneously. Even with the framework, many teachers prefer to rely on summative evaluation emphasising the degree of enjoyment of the process, rather than the quantity, quality or process of the learning.

Schunk suggests that "(r)ecent cognitive approaches to motivation highlight the importance of perceived control, goal-setting, self-evaluation, expectations and attributions" (1992, p. 9). Dweck concludes that in the last 10-15 years "a dramatic change has taken place in the study of motivation":

> *During this time, the emphasis has shifted to a social-cognitive approach ... to an emphasis on cognitive mediators, that is, to how children construe the situation, interpret events in the situation, and process information about the situation* (1986, p. 1040).

Dweck discusses research which illustrates that successful students are motivated by learning goals in which they seek to enhance their competence, rather than performance goals, in which they seek favourable, or to avoid negative, judgments on their performance . Children's theories of intelligence determine their approach to cognitive tasks. Children who consider intelligence as immutable demonstrate less persistence (McGuinness, 1993, p. 310). Mastery-oriented learners adopt adaptive motivational patterns which "promote the establishment, maintenance, and attainment of personally challenging and personally valued achievement goals." Helpless learners, in contrast, adopt maladaptive patterns which "are associated with a failure to establish reasonable, valued goals..." Mastery-oriented learners are persistent learners who enjoy "exerting effort in the pursuit of task mastery", while helpless learners show low persistence and anxiety (see also Ames & Ames, 1991 p. 248; Borkowski, Carr, Rellinger, & Pressley, 1990, p. 68; Covington, 1987, 1992; Dweck, 1986, p. 1040) Proximal goals which

incorporate specific standards of performance are more likely to enhance self-motivation and promote self-efficacy (Schunk, 1984).

Corno and Mandinach suggest that in many of the studies of motivation, motivational processes rather than learning processes are focal, and claim that "the literature seems to provide little information about the kinds of instructional activity that might influence an integrated cycle of "motivated learning" in the classroom" (1983, p. 88). When teachers use the stages of the New Zealand process framework to work with groups of students to set proximal goals and performance criteria for each stage, and coach them to monitor and evaluate their learning formatively, students do demonstrate this "motivated learning". The difficulty, it appears, is that few teachers seem to see that student ownership of goals and criteria contributes to motivation. Motivation seems to be regarded as something teachers do to students, like showing a video before the lesson sequence begins, not something students do to themselves.

Paris, Lipson and Wixson explore the relationship between awareness, motivation, instructional agents and strategic behaviour in self directed learning. They suggest that:

> *Motivation and metacognition arise in part from the social interactions of instruction and analyses of these factors must consider the entire learning context and not just target behaviors in isolation* (1983, p. 294).

They emphasise the need for the learner to perceive the purpose of the learning (ibid. , p. 308). Like Costa (1984, p. 88), they relate not understanding the purpose for learning to students' lack of learning control. In discussing theories of cognitive apprenticeship. Abbott states that early apprentices knew exactly why they were learning particular skills (1994, p. 71). While the New Zealand process framework assists students to develop proximal goals (Bandura & Schunk, 1981; Schunk, 1984) it is clear that many students see little purpose in researching a topic beyond satisfying the teacher's expectations (see also, Bruer, 1993; Moore, 1995b). Course records also show that teachers' expectations, in the initial stages of the course, seldom extend beyond the traditional 'project'.

In examining research concerned with negative motivation, Ames and Ames conclude that "a specific strategy focus would increase the student's sense of efficacy for success", and they question possible inconsistencies between student and teacher goals (1991, p. 253). The early studies of resource-based learning indicated that many students neither saw purpose in the exercise, nor possessed the requisite skills focus, and their goals were frequently not congruent with their teachers' goals. While the existing New Zealand framework provides a strategy focus, evidence from the courses suggests that teachers often assume student understanding of the learning purpose. Many expect little evidence of the resulting learning until secondary school - where direct teaching is still preferred to achieve recall for examinations.

Many of the writers who see a relationship between technology and increased student control of learning are constructivist in their orientation, for example Perkins, Jonassen, Duffy, Spiro and Feltovich, Zucchermaglio and Crook. There is explicit and implicit agreement in the literature that students find computers inherently motivating, at least in the short term (Beynon, 1993, p. 8; Farnham-Diggory, 1994, p. 83). Brown suggests that "(t)he best learning outcomes seem to be when the computer is used as a *tool* in combination with a learner-centred philosophy and collaborative and cooperative teaching strategies" (1995, p. 11; see also Crook, 1994; McMillan, 1993; 1995). The concept of control or ownership of learning is integral to motivation to learn in technology-enhanced environments (Bagley & Hunter, 1992, p. 23; Crook, 1994; Zucchermaglio, 1991, p. 252).

In the first instance, the control of the computer is in itself inherently motivating (Bagley & Hunter, 1992, p. 23; Dick, 1991, p. 41; Honebein, Duffy, & Fishman, 1991, p. 99; Kay, 1991). In the long term control of the learning implies controlling the cognitive and metacognitive processes of learning, and other aspects such as planning and evaluation, not just controlling the technology. Technology is seen as enabling the student to assume more control of the learning than is possible in a de-technologised environment (Beynon,

1993; Honebein, Duffy, & Fishman, 1991, p. 93; Kay, 1991; Knuth & Cunningham, 1991, p. 178; Laurillard, 1990, p. 65; Means, 1994, p. 16).

Student ownership and control has long been identified as a factor in the success of learning (Bagley & Hunter, 1992; Brown, 1994a). However, technological and software developments have caused the boundaries to shift and blur. It is the *context and purpose* of the learning, not technology, which determines whether the learning is toward teacher-direction or student control. This is only occasionally acknowledged in the literature (Brown, 1995; Laurillard, 1990; Maddux et al., 1992).

A continuum based on an acknowledgment that there are two dimensions of control - control of the technology and control of the cognitive processes - allows for this. Candy describes a comparable continuum from teacher-control to learner-control, where "each diminution in the teacher's control may be compensated for by a corresponding increase in the learner's" (1991, p. 9).

Brown and Palinscar discuss "inert knowledge", or "encapsulated information that is rarely accessed again" and "fails to become part of a usable store of knowledge":

> *A qualitatively different kind of knowledge acquisition requires the assimilation of new knowledge so that it is owned by the learner, readily accessible, and potentially applicable to related but novel situation* (1989, p. 394).

Ownership of learning is likely to be related to learning goals and intentions. Bereiter and Scardamalia see intentional learning as "cognitive processes that have learning as a goal rather than an incidental outcome" (1989, p. 362). The research on teacher understanding and application of resource-based learning cited earlier indicates that learning was often an incidental outcome rather than a goal. Course moderation records indicate that this persists to a degree, even after intensive training, possibly because many teachers seem reluctant to involve students in the planning of their own learning.

### Planning and goal setting

Goal-setting and planning are a key component of control:

> *Recent cognitive approaches to motivation highlight the importance of perceived control, goal setting, self-evaluation, expectations and attributions* (Schunk, 1992, p. 394).

Nelson and Narens call for theories "that construe people as systems containing self-reflective mechanisms for evaluating (and reevaluating) their progress and for changing their ongoing processing..." (1994, p. 7). Sternberg discusses intelligence as a "set of processes" comprising metacomponents, performance, and knowledge-acquisition components, seeing the first as "processes that we use to plan what we are going to do, monitor what we are doing, and evaluate what we have done" (1984, p. 40). The 'control' dimension of the information literacy learning assumes possession or guided development of these planning 'metacomponents'.

Zimmerman, Bandura and Martinez Pons examine the causal role of parental goal setting in students' efficacy beliefs and in self-motivated academic attainment (1992). Given the varied socio-cultural backgrounds of New Zealand students, parental expectations may exert more influence than has been considered to date in the development of the existing New Zealand framework, and in this study.

Scholnick and Friedman (1987) define planning as "a set of complex conceptual activities that anticipate and regulate behavior," and suggest that planning involves knowledge of the environment, the ability to define and evaluate goals, and to monitor and evaluate the execution of a planned action. They draw on Vygotsky's work in claiming that social interaction, modelling, and the use of planning aids are central to planning, and claim that the "motivation to plan has to be coupled with the capacity for self-control and self-regulation if planning is to occur" .

The planner needs to be able to represent the planned action mentally and be able to anticipate the outcome of actions (Bandura, 1986). Metacognitive and planning abilities are closely related (Paris, Cross, & Lipson, 1984, 1240). If, as suggested, planning is integrally linked to academic self-esteem, self-regulation and metacognition, teacher reluctance to involve students in planning would seem to be a major factor militating against assumptions 1 and 2: student ability to control learning and construct knowledge, and teachers' capacity to coach students to adopt active, metacognitive, critical and analytical approaches to information use and learning.

Resnick and Glaser's definition of a problem as "any situation in which persons encounter a task never before seen in precisely that same form, and for which the information necessary for a solution is insufficient" encompasses information literacy learning (cited in Covington, 1987, p. 472). There is ample evidence to suggest that the 'problem' in project or resource-based learning work is regarded by many students simply as finding, copying and pasting up (literally or electronically) any information on a given topic without analysis, synthesis or interpretation (Melchior, 1995; Moore, 1995a; 1997; 1998; 1992a; Rankin, 1992b; Robertson, 1991; Rudduck & Hopkins, 1984). If students' ability to represent the intended action mentally, to visualise the action and anticipate its outcomes, is limited by their lack of recognition of what constitutes an information 'problem', and their lack of modelled experience of information analysis, synthesis and *knowledge* construction, their ability to set goals, plan problem-solving learning actions, monitor, evaluate, and self-regulate their learning will be compromised.

## Self-regulated and self-directed learning

The ability to self-regulate learning is another key contributor to giving learners a sense of agency or control in their learning.

Schunk cites Zimmerman's definition of self-regulated learning:

> *(L)earning that occurs from students' self-generated behaviors systematically oriented toward the attainment of their learning goals. Self-regulated learning processes involve goal-directed cognitive activities that students instigate, modify and sustain* (1989b, p. 83).

Schunk's view of self-regulated learners as active "seekers and processors of information" (ibid., p. 83), and Pintrich and Schrauben's inclusion of planning, monitoring, regulating and resource management strategies within metacognition suggest that academic self-regulation, is the theoretical concept that links the 'control' component (1992, p. 161). Academic self-regulation, or "the degree to which students are metacognitively, motivationally, and behaviorally proactive regulators of their own learning process" illustrates the interdependence and inter-relatedness of the components (Zimmerman & Martinez-Pons, 1992).

Borkowski, Carr, Rellinger and Pressley say:

> *A review of existing research suggests that the self-system which includes constructs such as self-efficacy, self esteem, locus of control, achievement motivation and attributional beliefs, is a complex, interdependent system that supports both metacognitive functions and academic performance* (1990, p. 58).

Fusco and Fountain claim that for real learning to occur "students must be actively engaged in learning experiences that connect to their present knowledge and bridge to structures needed for future learning" (1992, p. 239). Jones and Pierce link learning with self-esteem: "When students feel that they are in control of their learning, they experience self-esteem" (1992, p. 74). This view is shared by other theorists who link self-management of learning, self-esteem and motivation (for example Cervone, 1993, p. 58; Levin, 1994, p. 15; Paris et al., 1983, p. 303; Schunk, 1984, p. 56; 1989, p. 83; Sternberg, 1987 p. 54; Winne & Marx, 1989).

Academic self-esteem refers to "a sense of empowerment, or self-efficacy" (Jones & Pierce, 1992, p. 74). Pintrich and Schrauben suggest that the student's *perception* of

control is more important than real control (1992, p. 176), that self direction as a method needs to be separated from self direction as a goal of education, and discuss the concept of learner control as a "series of continuums" where it is possible to exert different degrees of control over different dimensions (ibid. , pp. 8 - 9). Certainly, the assumption that constructivist information literacy learning can be implemented in scaffolded and coached steps and stages, supports his notion of self-direction as a goal, as distinct from autodidaxy as a method (ibid., p. 19).

> *Student involvement in learning represents the idea that motivational and cognitive components are operating jointly when the student engages in classroom learning... both motivational and cognitive components are essential to describe students' actual learning in the classroom... both motivation and cognition are influenced by the characteristics of the academic tasks that students confront in the classroom as well as the nature of the instructional process* (ibid., p. 149).

Pintrich and Schrauben outline the "entry" characteristics that students bring to the situation (ibid. , p. 152). Like Biggs (1987a; 1987b; 1987) and Sternberg (1984), they suggest that these influence the students' perception of academic tasks and response to instruction. They see planning, monitoring, regulating and resource management strategies as essential components of their model of cognitive engagement, alongside "knowledge (both prior knowledge about content and metacognitive knowledge), learning strategies and thinking strategies" (ibid., pp. 161 - 164).

Zimmerman and Schunk point out that self-regulation represents "a diversity of theoretical traditions - operant, phenomenological, social cognition (learning), volitional, Vygotskian and constructivist", and say that "(a)s an organizing concept, self-regulated learning describes how learners cognitively, motivationally, and behaviorally promote their own academic development" (1989, pp. ix - x).

> *The ability of self-regulation theories to explain student motivation as well as learning distinguishes them from other formulations and should make them particularly appealing to educators who must deal with many poorly motivated students* (ibid., p. 5).

## Metacognition

Metacognition is recognised as a key component in students' ability to construct knowledge, and in self-regulation of learning. For example, Ames comments on the movement toward defining "a broad conceptual framework for organizing both the cognitive and affective components of motivation within a theory of achievement goals" (Ames, 1992, p. 327; Johnson, 1990, p. 6; Paris & Winograd, 1990, pp. 18 - 19; Winograd & Gaskins, 1992, p. 225).

Metacognition refers to two dimensions of learning, self-appraisal and self-regulation.

> *In the past, metacognition was defined largely as an individual behaviour and was not initially linked to motivation. now, it is defined as shared behavior (thinking aloud), and it includes the learners' beliefs, judgements, attitudes, motivation and self-concept* (Idol, Jones, & Mayer, 1991, p. 73).

Paris, Cross and Lipson see metacognition as 'the executive function', embracing knowledge about cognition and, secondly, self-directed thinking, and involving both planning and regulation (1984, p. 1241). McGuinness, suggests that, according to the European theorists, self-regulation is synonymous with metacognition - "the primary tool for cognitive instruction" (1993, p. 311). Biggs says:

> *Whereas cognition refers to the what of learning, metacognition refers to the how: the process of learning, thinking and problem solving... "responsible self-direction" is what metacognitive learning is all about* (1991, p. 3).

Abbott cites Gardner's description of metacognition as the "ability to 'think about thinking', to be consciously aware of oneself as a problem-solver, and to monitor and control one's mental processing..," suggesting that metacognitive instruction:

> ... *attempts to transfer in stages the critic's role from the teacher to the student, whereby the student is progressively weaned of his/her dependence on the teacher and encouraged to become an independent learner* (1994, p. 83).

Costa links metacognition to planning and reflection, and links it to the importance of the student's existing knowledge base in terms of "our ability to know what we know and what we don't know" (1984; see also Biggs, 1991, p. 3; Cervone, 1993; 1984, p. 57; Fusco & Fountain, 1992, p. 239; Graesser, Person, & Huber, 1993; Resnick, 1989a, p. 1; Schunk & Meece, 1992; Sweller, 1989). This acknowledgment of the importance of building on students' existing knowledge base is congruent with the existing New Zealand framework emphasis in Stage 1 on using cognitive strategies (brainstorming, concept, hierarchical and semantic mapping) to get students to work out what they know and develop questions. Candy emphasises the ownership of questions in metacognition, and in developing self-direction in learning (1990b, p. 19; see also Graesser, Person, & Huber, 1993; Rankin, 1992a; Sheingold, 1987).

Flavell distinguishes between metacognitive knowledge and experience, metacognitive and cognitive strategies (cited in Garner, 1987, p. 16). Metacognitive knowledge is seen as knowledge about ourselves, tasks and strategies. Earlier writing on metcognition saw metacognition as synonymous with metamemory. Later writings are, as Garner suggests, "fuzzy", with nearly all strategic actions called metacognitive (ibid., p. 17). Flavell's distinction between person, task and strategy variables in metacognition provides more precision (1977, p. 105), and relates well to Sternberg's (1987) internal, external and experience variables in his triarchic theory. It suggests that within constructivist information literacy learning there needs to be an equal emphasis on assisting learners to think about themselves as learners, to reflect on the context, and the best strategies for learning about the topic. Self-regulation through "metalearning" (Biggs, 1987a) relates to the assumption that students will achieve control and be able to construct knowledge only if they are taught to use relevant information literacy skills *strategically* in context.

Ames and Ames suggest that "(b)eliefs in competence and a focus on effort are closely related, in that a students who believes he or she can accomplish a goal usually is aware of a strategy for reaching the goal and engages in strategic effort to accomplish the goal" (1991, p. 263). Zimmerman and Martinez-Pons cite studies relating students' low perceptions of academic competence to lack of strategies and competence in "metacognitive monitoring" (1992, pp. 185 - 186). Paris, Lipson and Wixson comment that because "the learner's intentions, choices and efforts underlie self-controlled reading, strategic behavior is clearly involved, and suggest that "strategies combine components of both skill and will"; personal significance, utility and efficiency and self management of resources being the three key features of strategic behaviour (1983, pp. 293, 304).

Control is a complex construct to which many internal and external factors contribute. What is clear from the literature is the emerging consensus that, without control, students are unlikely to want, or try, to be active, engaged learners. Teachers have a critical role to play in developing the classroom culture and designing information literacy learning environments which support the development of control. The notion of control provides an organising concept which combines skill and will - the cognitive strategies, but also the metacognitive and self-regulatory strategies which determine motivation and ownership of the learning.

### Assumption 2: Students will only learn to control their learning if this learning is coached/ mediated

Information literacy learning cannot be an 'add on'; it is an integral part of the curriculum in New Zealand and must be developed in the context of the curriculum. This section explores theoretical support for the suggestion that if constructivisi information literacy learning is to be integrated into the curriculum the teacher's role is critical.

In constructivist writing the learner's ability to control the learning and the teacher's ability to guide, scaffold and coach the learning are seen as interdependent - two sides of the same coin (Hyerle, 1996; Jonassen, 1996). Analysis of early RBL studies indicated

that lack of success was proportionate to the teacher's assumption that students could achieve resource-based learning goals simply by being directed to 'go and look it up', often with the complementary assumption that standalone library skills (or bibliographic instruction) courses would ensure transfer of the skills to 'research'. There is little empirical evidence to support these assumptions, but substantial theoretical support for the second assumption made here in relation to information literacy learning - that most students will only learn to control their learning if it is coached or mediated. There is, likewise, evidence that, however well designed and resourced the Schools For Thought (SFT) programmes are, in the hands of insufficiently confident or experienced teachers, their impact is compromised (Lamon et al., 1995).

Collins, Brown and Newman emphasise the role of the teacher in six functions: modelling, coaching, scaffolding and fading, articulation, reflection, exploration using a skills process framework (questions, summarising, clarification and prediction) (1989, pp. 458-465). They comment that the "key goal in the design of teaching methods should be to help students acquire integrated cognitive and metacognitive strategies for using, managing and discussing knowledge" (ibid: 480).

It may be important to differentiate between direct instruction in a procedural context, direct instruction in a curriculum content context, and instruction in standalone skills programmes (Collins, Brown, & Newman, 1989, p. 464; Mulcahy et al., 1991). Integration is increasingly seen as integration into a *strategic process used within a curricular context* (Beswick, 1987; see also Brown, Collins, & Duguid, 1989; Collins et al., 1989; Frederiksen, 1984; Isaksen & Parnes, 1985; Nisbet & Shucksmith, 1986; Novak & Gowin, 1984; 1985; Novak, 1990; 1998).

Process frameworks, allow skills to be taught *strategically,* and to transfer to other strategic processes. Within process frameworks, the following learning behaviours need to be modelled, scaffolded, and mediated by the teacher:

- **establishing existing knowledge base** (Kerwin, 1993; Novak & Gowin, 1984); **seeing purpose in learning** (Abbott, 1994; Gardner, 1993); **knowing expectations** (Garner, 1987; Wiske, 1997); **self-analysis of learning and thinking styles, concept of learning and self as learner; conscious use of metacognitive strategies** (Morgan, 1993; Paris & Winograd, 1990, p. 15; Rowe, 1991), see also Appendix 1.

- **knowing the type of information needed** (Taylor, 1991a); **understanding about knowledge, for example structural, heuristic and strategic** (Jonassen, 1996; Paris et al., 1984, p. 1241; Taylor, 1991a, p. 181); **developing relevant questions, distinguishing between factual and inferential questions, seeing the problem** (Candy, 1990b; Covington, 1987).

- **selecting, comprehending and summarising information** (Collins, Brown & Newman, 1989); **applying thinking skills** (Bereiter & Scardamalia, 1985; CERI, 1991; Edwards, 1991; Perkins, 1992; Perkins, 1997; Perkins, Jay, & Tishman, 1993; Resnick, 1989b; Scriven & Fisher, 1993) **developing mental models or 'content and textual' schemata** (1993; Gagne, 1972; Garner, 1987; Halford, 1993; Johnson-Laird, 1983; 1996; Jonassen, Beissner, & Yacci, 1993); **using scaffolding / frameworks** (Brown et al., 1989, p. 61; Pearson & Raphael, 1990, p. 218) ( see also Appendix 1).

- **self-reflecting** as learners and **self-evaluating**; understanding and talking about learning processes (Brown, Collins, & Duguid, 1989; Gardner, 1993; Morgan, 1993; 1990) **keeping learning diaries or portfolios** (Candy, 1990b; Kirby & Kuykendall, 1991, pp. 9, 38).

Halford distinguishes between knowing *that* and knowing *how* (1993, p. 16). To be able to make information into knowledge, students clearly need to know how.

Information process frameworks provide the 'how' scaffolding, but, teachers themselves might not have sufficient competence in the areas outlined above to 'cognitively coach' the strategies. Like Abbott (1997) Smith stresses the need for a new paradigm:

> *...that not only links teaching and learning but also links teaching and learning to learning to learn... Teaching becomes more learning-centred and consequently learning-to-learn-centred. Education becomes a process of not only arranging environments and conditions for learning to occur, but, equally, important, for learning to learn to take place..."* (1990, p. 25).

## Cognitive apprenticeship

As suggested previously, cognitive apprenticeship provides a paradigm which allows for the expert/novice learning partnership (Brown et al., 1989; Lave & Wenger, 1991; 1996a; McLellan, 1996b; Rogoff, 1990; Thomas & Rohwer, 1993). Collins, Brown & Newman emphasise, as did Vygotsky, Bandura and others, the key role played by models and modelling, "students fail to use resources available to them to improve their skills because they lack models of the processes required for doing so", and advocate cognitive apprenticeship as a model for the integration of cognitive and metacognitive processes (1989, p. 455).

Resnick (1989b) attacks the notion that students can be left to discover things for themselves, and outlines a role for what she calls 'cognitive bootstrapping' which aligns well with the constructivist notion of scaffolding, modelling, coaching and fading. The links between "observation, scaffolding and increasingly independent practice" which Collins, Brown and Newman see as integral to cognitive apprenticeship are, likewise, integral to information literacy learning (1989, p. 456). Paris, Cross & Lipson comment on how seldom explicit instruction is provided in the metacognitive strategies that improve reading (1984, p. 1241). This may well relate to the confusion, perceived by Candy (1991), between self-regulated, self-directed and autonomous learning, and the tendency for teachers setting projects to confuse resource-based learning with sending students away to 'look it up' autonomously (for example, Robertson, 1991).

There is disagreement on the extent to which metacognitive and learning-to-learn strategies can be taught directly. Mulcahy, Short and Andrews cite numerous studies which point "to the effectiveness of cognitive interventions with differing populations", but suggest that the limited amount of longitudinal research that exists supports the integration of this instruction into curriculum content (Mulcahy et al., 1991, p. 196). This is a position supported by Tabberer (1987; 1983) Gibbs (1977)), Bereiter (1985), Gagne (1993) Kennedy, Fisher and Ennis (1991).

## Learning to learn

Costa, Bellanca and Fogarty suggest that metacognition, creative thinking, critical thinking, multiple intelligences, teaching for transfer, and life-long learning are closely related, and achieved through teaching students to learn how to learn (1992, p. 18). Many recent 'learning to learn' writings are based on similar assumptions of student control, construction of knowledge and contextualised and strategic use of skills (Brown, Campione, & Day, 1981; Mulcahy et al., 1991; Nisbet & Shucksmith, 1986; Novak, 1998; Paris et al., 1984; Pearson & Raphael, 1990; Rowe, 1991; Zimmerman & Martinez-Pons, 1992).

All these writers suggest that students need instruction in order to develop skills and use them strategically. All support the assumption that students *can* learn to construct their own knowledge if they are helped to do so. Where there is less consensus is precisely which skills and strategies are required, and in the nature of the help needed.

Brown, Campione and Day (1981, p. 19) introduce a 'tetrahedral' model with considerations for instructing students in ways to enhance their own knowledge: the activities of the learner, learner characteristics, nature of materials, and the critical task. This has particular relevance to information literacy learning in emphasising materials.

Earlier out-of-context programmes tended to emphasise memory, reading and notemaking skills. More recently these skills have appeared in the guise of 'accelerated' learning packages (for example, DePorter, 1993; Dryden & Vos, 1993). Some writers still see metacognition and metamemory as synonymous, confusing learning with cognitive processes and 'study strategies' (Ormrod, 1995).

Given that information literacy learning is not about recall and retention, but about using documented information to construct knowledge, the current work that provides most insight into the third assumption is emerging from constructivist educators working in the fields of reading and thinking. Since it is difficult to select or interpret information or transform it into knowledge *without* reading and thinking, this is not surprising. What *is* surprising is the comparative dearth of classroom pedagogies. The SPELT model is a notable exception at classroom level (Mulcahy, Short, & Andrews, 1991, p. 197). However, the approach which best supports the assumption that strategic skill use needs to be taught within the information process is that of Collins, Brown & Newman (1989). Their questioning, summarising, clarifying and predicting process supports the construction of knowledge from information - library-focused in much earlier RBL writing.

**Assumption 3 : That constructivist information literacy learning can be contextualised within the context of the New Zealand curriculum and classroom (context)**

Schools are frequently seen as environments that are inhospitable to the type of learning and teaching envisaged in this constructivist model of information literacy learning (for example, Abbott, 1994, p. 31; Biggs, 1991, p. 8; Brown, Collins, & Duguid, 1989, p. 3) Baird and Mitchell (1987) in the Peel Project demonstrated how little support the traditional secondary school structure provides for anything other than 'knowledge telling' and the distinct lack of student zeal for this kind of learning in the first instance.

The curriculum itself is contextualised; interpreted at national, school and department (secondary) or syndicate (primary) levels. Teacher autonomy is an illusion. With large classes, little time for planning, and over-full curricula, it is easy to find evidence of why Paris and Oka call projects a 'mirage of teaching' (1986, p. 28), and why Corno and Mandinach assert that learners often avoid self-regulation in cooperative learning contexts by 'managing external resources' (using peers' knowledge to avoid building their own) (1983, pp. 96, 106). Brown, Collins and Newman, likewise, see projects as poor models which do not necessarily encourage "deeper understanding of meaning of concepts and facts" (1989, p. 47).

Increasingly the boundary between projects and cooperative learning is blurring at classroom level. Some see reciprocal and cooperative teaching as supporting the three assumptions (for example, Berndt & Keefe, 1992; Fogarty & Bellanca, 1992, p. 14; Levin, 1994, p. 18; Palinscar, Brown, & Martin, 1987; West, Farmer, & Wolff, 1991, p. 18). Others see approaches like reciprocal and cooperative learning as palliative measures, insufficient to deal with the 'hyperlearning' required in the information age. They question schools as learning environments (for example, Perelman, 1992). Bruer suggests that school culture "makes knowledge telling a rational, rewarding strategy" (1993, p. 242). He claims that "the new cognitive learning theory and its many potential applications don't automatically translate into better teacher practices" and that "many common practices send students the wrong message" ( Bruer, 1993, p. 258; see also, Rosenholtz & Rosenholtz, 1981, p. 133). Bruer considers the value of projects implemented in Gardner's Key School project as authentic learning opportunities, but reiterates the need for carefully targeted instructional support by the teacher (see also, Borkowski et al., 1990, pp. 82 - 83; ibid., p. 268; Corno & Mandinach, 1983; Schunk, 1984, p. 48; 1981, p. 95).

Numerous constructivist educators emphasise learning as a social activity, and the integral role of the teacher in interacting with students to shape the learning environment (for example, Brown, 1994b; Chipman & Segal, 1985; Crook, 1994; Idol & Jones, 1991;

Lave & Wenger, 1991; Resnick, 1989b). However, the uncritical acceptance of cooperative learning is also being challenged. Becker describes Slavin's attempts to integrate Integrated Learning System advantages (adaptation to individual's prior knowledge and learning rates) into cooperative learning projects and suggests: "(o)nly when students remain individually responsible for their own achievement and productivity do substantial improvements in academic outcomes arise from group (team) rewards and collaborative activity" (Becker, 1992b, p. 13). How learning is defined determines criteria for success. Does the use of co-operative strategies to learn information to pass tests constitute knowledge construction?

**Constraints**

Theory and research support the assumption that students *can* learn to control their own learning, construct and apply knowledge confidently, critically and creatively, given the context and the scaffolded skill and strategy support outlined above. However, given the reality of life in schools for students and teachers, it is likely that few will. The contextual constraints have been clearly identified in the literature. They include factors relating to time, planning, knowledge, assessment and transfer.

**Time:** Time is considered by many to be the one of the most significant barriers to constructivist learning. Kirby sees schools as the pedagogical equivalent of TV (1991, p. 38). Like Abbott (1994) he sees the need to reduce curriculum coverage to give students time to develop the learning-to-learn strategies they lack. Farnham-Diggory emphasises the need for students to do their own learning; no one else can learn *for* a student (1992, p. 93). Constructivist learning needs time and learning-to-learn skills; Collins, Brown and Newman (1989, p. 61) suggest inevitable 'task complexity', and, like Bandura (1986, p. 2), see the need for 'cognitive rehearsal' - inevitably, *slower* and more challenging for students *and* teachers than teacher-directed learning.

> *The most serious consequence of the decision to educate for understanding is a radical forshortening of the curriculum. If one wishes to have any chance of securing understanding, it becomes essential to abandon the misguided effort to "cover everything". Broad coverage ensures superficiality... Rather, one must move toward "uncoverage"...* (Gardner, 1993, p. 191).

Curricula and timetables expand to accommodate new subject areas like technology (Ministry of Education, 1993a), but pay lipservice to the key interrelationship between students' information and cognitive skills, their ability to transform information into knowledge, and their resulting self efficacy. The report on the recent national monitoring of information skills suggests that there is evidence that curriculum breadth is being achieved at the expense of depth (Crooks & Flockton, 1998). There is no acknowledgment that it would be impossible to cover required content using constructivist problem-solving approaches *without* sacrificing depth. Because constructivist approaches predominate in the individual Curriculum Statements, teachers are caught in the bind between knowing what they should be doing, and knowing what they *have* to do to cover required content.

**Planning:** Most New Zealand primary teachers have no release time, and their secondary counterparts little. Because specialist teachers are not employed in primary schools, most primary teachers take on an area of curriculum or professional responsibility in addition to their fulltime teaching roles, for instance computers, staff development, a curriculum area, or the school library. Curriculum planning is often done in syndicates (primary) and departments (secondary) and usually focuses on *what* topics will be taught rather than *how* they will be taught or learned. In other respects teacher planning seems to follow overseas precedent in that it focuses on teaching and resources (what and with what) rather than why and how learners will learn - on teaching experiences and tasks. Time is of the essence and teachers do what they know 'works' for them (Doiron, 1993; Moore, 1998). The time needed to plan a complex, authentic constructivist learning environment and anticipate learners' needs and responses in order to embed the scaffolds and strategies needed to help students to control their own learning

is a major barrier, as is the need to provide adequate inservice training for teachers new to these environments (Lamon et al., 1995).

**Knowledge and experience:** The demands on teachers in information- and IT-enhanced generative learning environments are significant (Lamon et al., 1995). Few teachers have, themselves, had experience as learners in such environments. Apart from the pedagogic knowledge demands, there is also the need for technological knowledge and support. This simply not available in most New Zealand classrooms. 'Computer' teachers have full class teaching loads, and technicians are seldom employed in primary schools. The Vanderbilt group and the interim evaluation of the SFT project have provided valuable evidence of the level of technical and pedagogic support even enthusiastic (and relatively experienced) teachers need (Lamon et al., 1995).

Idol, Jones and Mayer see it as 'vital' for teachers to demonstrate effective and ineffective strategy use, address time management, and coach learners to "plan monitor, evaluate, and revise their learning as well as to set goals and evaluate their own learning" (1991, p. 73). In describing the SPELT programme, its authors describe how the teacher in actively involves the student in the learning process:

> *A learner's repertoire of strategies is thus seen as a set of tools that enables him/ her to more effectively and efficiently activate and regulate important cognitive activities such as attention, comprehension, retention and retrieval of information, thinking and problem-solving* (Mulcahy, Short, & Andrews, 1991, p. 197).

It could also be argued that teachers working in constructivist environments need extensive domain knowledge (Bell & Gilbert, 1994). New Zealand primary teachers are generalists. Few have subject degrees. Their training covers pedagogy rather than domain knowledge. Inadequate domain knowledge may well prejudice their ability to plan constructivist learning.

Several writers see the need for teachers to work out how students think, and how to help them with metacognitive strategies (Paris & Winograd, 1990, p. 15; Rowe, 1991). Eliciting and working on students' conceptions of learning may be a prerequisite to this (Morgan, 1993), and teachers may need to develop strategies which focus students on the need for transferring skills (Lawson, 1991). Teachers who have never themselves experienced learning in a cognitive apprenticeship climate may benefit, themselves, from apprenticeship models of professional development (Farnham-Diggory, 1992, p. 101). Without the benefit of targeted professional development, it is unlikely that teachers will have the pedagogic, or technological, knowledge to cope. In short, teachers need both domain knowledge and pedagogic content knowledge to plan information literacy learning.

**Assessment:** As discussed in Chapter 1, Education Review Office (ERO) assessment requirements conflict in principle with what might be appropriate for constructivist information literacy learning. There is increasing acceptance of portfolios for school-assessed subjects, and an acknowledgment of the importance of documenting the processes as well as the products of learning. However, despite the infusion of information literacy objectives throughout the school curriculum, course records demonstrate reluctance to involve students in developing criteria, self-monitoring or self-assessment.

**Transfer:** Transfer of knowledge and skills to other curricular and extra-curricular contexts is an acknowledged concern, particularly at secondary level (for example, Macpherson, 1996, p. 6). However, it is seldom addressed directly. The Essential Skills are intended to be integrated into all school curricula. The levels and strands represent a 'spiral curriculum' intended to achieve transfer, but this is not made explicit (Ministry of Education, 1993a). While many constructivist designers make explicit provision for transfer within their knowledge construction environments, there is little mention of teaching for transfer in the information literacy literature although there is widespread recognition of the failure of standalone library programmes in this regard. The question is whether, by making it easier and for teachers to design this information literacy learning,

more students can be helped to control their own learning, and whether this facilitates transfer.

## Summary

The three assumptions are supported in broad terms by theories of cognition and learning. In particular, the work of Vygotsky, as well as current constructivist approaches, work in situated cognition, and work in the area of applying learning-to-learn, thinking and reading strategies, supports and illuminates the assumptions. The literature suggests that students *can* plan, monitor and self-manage their own learning, construct knowledge, and use skills strategically within the information (or other learning) processes, particularly if they have self-efficacy as learners, and given an authentic purpose and context for learning.

However, while the three assumptions underpinning a constructivist model of information literacy learning are supported in broad terms at a theoretical level, it is in their application within classroom information literacy learning that they are most challenged.

Firstly, the whole notion of school as an authentic learning environment, and the way learning is atomised and fragmented, needs to be challenged. Information literacy learning is only one approach to learning, only one of numerous approaches used in a teaching week. Without regular and sustained use of the skills and strategies, without regular coaching and modelling by a skilled teacher, and without curriculum contexts that are inherently interesting and perceived as relevant, it is likely that none of the assumptions will be realised.

Secondly, students who cannot see the purpose of information literacy learning, for whom few curriculum topics have sufficient intrinsic interest to fuel the desire to self-direct their learning, for whom secondary school still means recall and regurgitation, whose mental model of the process is limited by previous experience of information pastiche projects, and who have never seen the skills modelled in the context of the process, are not likely to have the self-efficacy, the motivation, or the self-regulatory skills to plan, monitor and evaluate information literacy learning, or the tenacity to identify and overcome problems inevitably encountered in the process (Moore, 1995a; 1998; Rankin, 1992b).

Thirdly, while the theory supports the notion of information literacy learning as an ideal vehicle for student-centred, self-regulated, active and self-reflective learning, there are also significant questions indicated about most teachers' ability to identify individual and group learning needs, coach, scaffold and fade until students develop a sense of ownership, agency and efficacy. Even where teachers themselves *do* have the required understandings and skills, it requires exceptionally skilled and carefully planned use of classroom management and pedagogic strategies, using, for example, peer tutoring in the framework of reciprocal teaching as outlined by Palinscar, Brown and Martin (1987) to manage large groups of challenging learners. There is little recognition in the information literacy literature of the demands this type of teaching makes on even the best and most motivated teachers. One of the study participants summed it up as "tough teaching, magic learning". It is important to recognise how challenging the coaching assumption is for even the best teachers, and the danger must be acknowledged that any learning process framework might constitute a well-intentioned palliative, based on assumptions that are ideologically worthy and theoretically sustainable, but often jeopardised in classroom application by the sheer complexity of the school and classroom as a bureaucratic, hectic, anti-learning culture (Perelman, 1992).

# CHAPTER 5

# DESIGNING A PEDAGOGIC FRAMEWORK FOR CONSTRUCTIVIST INFORMATION LITERACY LEARNING: Cycle 4

## Introduction

This chapter begins by examining two studies which purport to set information literacy in a constructivist context. The purpose is to highlight and explore issues that affect the design of information literacy learning; issues that have, arguably, limited the theoretical and pedagogic development of information literacy to date. This is followed by a brief examination of Vygotskian concepts useful for designing constructivist information literacy learning, and of how traditional instructional design (ID) and evolving constructivist approaches to designing learning (DL) might contribute to the CILL pedagogy.

Cobb says "As a theory, constructivism is often reduced to the mantra-like slogan that 'students construct their own knowledge'," adding:

> *Pedagogies derived from constructivist theory frequently involve a collection of questionable claims that sanctify the student at the expense of scientific ways of knowing. In such accounts, the teacher's role is typically characterised as that of facilitating students' investigations and explorations* (1994, p. 4; see also, Duffy & Cunningham, 1996).

Bereiter comments:

> *The slogan "students construct their own knowledge" is not by itself a falsifiable claim. It is simply a concomitant of any cognitive stance - including the stance of folk psychology* (1994, p. 21).

The attempt to design a constructivist framework for information literacy learning is likely to be vulnerable if it is driven by the simplistic premise that, in using information as a resource for learning, students are constructing knowledge, so therefore resource-based learning is constructivist. Kuhlthau's (1993a) paper, which explicitly sets the information skills process into a constructivist paradigm, is based on just this premise. The significance of this paper extends beyond its claims to be constructivist. It highlights some of the enduring professional and pedagogic tensions inherent in 'library-centred' writings.

## Designing constructivist information literacy learning : two examples

Kuhlthau says that "(u)ndergirding the process approach to information skills is a constructivist rather than a transmission view of learning" (ibid., p. 11). However, she cites only one other writer, a school library media specialist, in support of her premise, and uses only Kelly, Dewey and Bruner as theoretical instantiation for her *library research* stages as being constructivist (ibid., p. 12). The stages (task initiation, topic selection, prefocus exploration, focus formulation, information collection, search closure and presentation/ starting writing) were established in Kuhlthau's PhD study which focused on college students doing research in libraries (1989; 1987a; 1987b; 1988a). The leap between gathering information in the library in the 'collection' phase and interpreting and

transforming information into knowledge in the 'presentation' phase is never satisfactorily made.

Kuhlthau asserts that "(t)he constructivist view... builds on what students already know and actively involves them in learning through the use of a variety of resources", and, further, that "(c)onstructivist theory provides a sound basis for library media programs in the information-age school" (op. cit., p. 11). In contrast, some RBL writers see links between the information process and behaviourism (for example, Herring, 1996). She continues "(a) constructivist perspective requires access to a wide range of materials for learning and advocates developing information skills for learning from a variety of sources" (op. cit., p. 11). In reality, the validity of externalised bodies of 'given' information is challenged by the radical constructivist position which sees all knowledge as constructed by the individual learner (Cunningham, 1991). Driver (1994, p. 5) and Laurillard (1993, p. 24) both address this in relation to scientific knowledge and reach an uneasy compromise between honouring the individual's construction, and learning as social negotiation with consensual, socially constructed, 'articulated' domain knowledge.

After running short 'institutes' for library media specialists in 'the information process' Kuhlthau comments:

> *After two years of collecting responses, the researcher found that certain patterns began to emerge. Some programs seem to be stalled, while others achieved one success after another. Participants in the stalled programs cited three primary inhibitors: lack of time, confusion of roles, and poorly designed assignments* (op. cit., p. 14).

Kuhlthau blames teachers - classes had insufficient time in the library, teachers and library media specialists had insufficient time to plan their 'teaming', and assignments "did not encourage a process approach" (op. cit., p. 14). She does not explain how teachers who had, apparently, not been to the institutes, were expected to understand the transition they were supposed to make "beyond the traditional roles of the library media specialist as resource gatherer and the teacher as assignment giver" (op. cit., p. 14). She says:

> *In fact, some assignments actually seemed to impede learning. Assignments were primarily designed by the teacher with the library media specialist joining in some time after initiation and frequently much later in the process. Many assignments were "added on" rather than being an essential component of the course of study and directly integrated into the subject-area-curriculum. To make matters worse, the assignments were sometimes given at the most inconvenient time of the school year... Even the most enlightened teachers seemed to regard library assignments as enrichment activities rather than as ways of learning essential concepts and for developing basic skills for addressing emerging questions.*
>
> *In summary, lack of time, role confusion and poor assignments were the main problems participants identified as preventing successful implementation of process-oriented library media programs* (op. cit., p. 14).

Do 'enlightened teachers' cede responsibility for their curriculum planning and teaching to librarians? Kuhlthau's results beg the question whether teachers might have benefited more from the institutes than library media specialists who could have been expected to understand the information process anyway.

New Zealand does not employ library media specialists like America, or teacher-librarians like Canada and Australia, or school librarians like secondary schools in Britain. Information literacy learning is the responsibility of the classroom teacher. While it is clear that their own training and experience have left them ill-equipped to deal with it, it removes the factor of role-confusion and library-centredness which persists in much of the existing empirical work and this study by Kuhlthau. Empirical evidence in New Zealand *does* reinforce Kuhlthau's contention that there are few classroom teachers equipped with the

knowledge of information sources, resources and process to guide the location of information, and few librarians who have the student knowledge and teaching experience to coach the knowledge construction aspects (Chalmers & Slyfield, 1993; 1995a; Moore, 1995b; 1998).

Through focus interviews with key players in one 'success story' school Kuhlthau (op. cit., p. 16) derives 'ten critical elements' grouped into 'four basic enablers' representing 'underlying principles for successfully implementing a process approach to information skills':

1. a team approach to teaching with administrators, teachers, and library media specialists playing essential roles in the instructional team;
2. a mutually held constructivist view of learning compatible with the process approach that provided the foundation for actively engaging students in problem-driven inquiry;
3. a shared commitment to teaching skills for lifelong learning and for motivating students to take responsibility for their own learning;
4. competence in designing activities and strategies to improve student learning.

In fact Kuhlthau is NOT claiming to embrace information literacy learning but the information skills process which is used here as a tool within the library. The 'institutes' taught the process to library media specialists in anticipation of take-up by classroom teachers. This could be seen as an naive expectation, and a flawed basis for extrapolating even tentative, design principles.

New Zealand has been running such courses *for teachers* for fifteen years and has built up an extensive base of practical experience. Since 1992 school-based 175-hour information literacy courses have run, initiated by the school's principal, with entry negotiated with the programme's national co-ordinator. As such, Kuhlthau's first three conditions are conditions of entry to the course, not the results of training. It is because principals and teaches are, do and value, at least in principle, the first three, that they buy training to achieve the fourth. The degree of competence achieved relates to teachers' ability to *adapt* and *embed*, within the constraints of curriculum, classroom, student abilities, and timetables, the learning activities that are *taught* in relation to each of the information process stages (Gawith, 1998).

The perceived success of these efforts has been documented in two major official studies (Lealand, 1991; Ministry of Education, 1993b). The course developer is unconvinced. The issue at the heart of this *current study* is the fourth issue, whether teachers can themselves *design* constructivist information literacy learning strategies to enhance student learning, not just information-pastiche projects. Secondly, can they *implement* these strategies within the constraints outlined above, ensuring that students construct *knowledge* from the information they retrieve?

Kuhlthau acknowledges the need to go beyond fact collection and to focus on "skill in using information", claiming that "(i)nformation skills that incorporate location and interpretation skills prepare students for the full range of information seeking and use in an information society" (op. cit., p. 11). However, while significant space in her paper is devoted to finding and using information in the library, interpretation is seen as being achieved in the successful school because this element was dealt with by the 'reading and study skills specialist'. She concludes that only a team is able to contribute the degree of individual teaching specialism needed, saying "It requires development of an instructional team and a break with the traditional concept of one teacher to one classroom" (op. cit., p. 16). While the notion of cooperative planning and teaching (CPPT) has long been established in the literature of information skills, Kuhlthau's conclusion begs further analysis. Is she saying that the process is so multi-faceted and complex that what can only be taught by a team of specialists must, in fact be learned and practised by students who are relative novices? This is a concern in the New Zealand context where there are no

library media specialists or 'reading and study skills specialists' to work with the classroom teacher. The pedagogic argument in this paper would suggest that the CILL study is therefore futile. The researcher argues that it merely demonstrates that a pedagogy reflects its ontological and epistemological origins, and the professional world view, and view of knowledge of many the first and second generation RBL writers remains firmly library/information-centred.

If it is contended that learner-centredness is an essential constituent of constructivism (McNaughton, 1996), Kuhlthau's information process, from the evidence in this paper, remains firmly library-centred, and as such, pays lip service to constructivism.

This study seeks to emphasise the constructivist elements which Kuhlthau fails to integrate - the internal and external contexts which define the learning, the need for the *student* to control the learning, and the need for *explicit* strategies for cognitive mediation/ coaching so that knowledge can be constructed from the information retrieved from libraries, but also from people sources in the community, and electronic sources (like the Internet).

The significance of Kuhlthau's paper is that it represents the first professed attempt to *design* a constructivist approach to the information process. It remains, in practice, tied to the traditional American behaviourist bibliographic instruction model. It evidences professional attitudes which have, according to Cavalier (1993), contributed to a perceived professional chasm between librarians and educators, Bruce's (1996b) work notwithstanding. Kuhlthau is a visionary contributor to the information literacy movement, but in the empirical realisation of her vision in this paper there are gaps between 'espoused theory' and 'theory in action' (Schon, 1983). Behind Kuhlthau's eclectic selection of theorists to reinforce her 'constructivist' stance there is essentially a base of assumption and wishful thinking.

This current study is vulnerable to precisely the same flaws.

The second paper is a year-long 'action research' study of 40 teachers 'teaching information problem solving' in New Zealand primary schools (Moore, 1998; 1999). The author's comment that "teachers did not have a coherent view of information and information-use in schools" (Moore, 1998, p. vii) is less surprising than her conclusion, after spending four days in the schools over the year, that, having been introduced to her (unacknowledged) 5-stage version of the Marland/ Irving (1981) 9-stage information process framework she concludes that information skills "remained part of the hidden curriculum" (op. cit., p. 90).

The author is well read in terms of Snelbecker's (1983) 'knowledge producer' paradigm, but the study is flawed by her lack of practitioner 'knowledge user' knowledge as teacher or librarian. She simply does not know teachers, schools or school libraries. Her study demonstrates the same tension between information use in libraries and information use for learning highlighted in the 1970/ 80s studies, notably Thomson and Meek (1985), and Kuhlthau's study (above).

Moore (1998) calls her process 'information problem solving' and sees 'reciprocal teaching' as a means. It was unclear whether her initial 'training' sessions were intended to equip teachers to use reciprocal teaching and/or her model. Her study evaluates neither. Instead, the report is a library-focused account of how children did/ did not find information, together with broad and subjective generalisations about teachers and their ability/ inability to model metacognitive activities. It appears to proceed from an (unstated) assumption that, on the one hand, 'information problem solving' relates to libraries, and, on the other, that it is a synonym for all 'good' (as assessed by Moore) learning and teaching. She concludes that good teachers help students to evaluate and articulate their thinking. She says teachers failed to pick up on 'reciprocal teaching', but does not acknowledge that New Zealand teachers already *use* collaborative methods (as

evidenced in the research data in Chapters 7, 8). With reciprocal teaching introduced as a teaching method in the context of an alternative information process model, presented as something new and original, it would have been reasonable for teachers to assume that this was how you taught *this* model. Since they did not seem to *use* the model except as a basis for discussion, it follows that they did not 'do' reciprocal teaching.

Moore's stages - Information need, Resources: select/locate, Evaluate resources, Extract information, Process and present - are, arguably, *more* library-centric than even the Marland/Irving 1981 original. It is the 'library project' model exemplified. 'Process and present' is instantly recognisable as 'information pastiche cognitive bypass learning'. However, her reference to Vygotskian concepts of scaffolding, "(t)his would support a strategic approach to information retrieval and use plus the development of metacognition" (op. cit., p. 45) hints at a broader view than this limited, library-centric study.

Moore's study highlights the danger of eclectic selection of pedagogies with no grounding in theory. It also highlights the ease with which action research can become subjective observations and generalisations. However, the National Education Monitoring Programme findings on information skills *do* confirm her observations about low level of information literacy on the part of New Zealand primary students (Crooks & Flockton, 1998).

Sanger's (1989) study, which used methodologically sound action research, provides deeper insights into why the focus became probing analyses of teaching in general, of students, classrooms, constraints, theories, practices that 'worked'. It is clear that, without a teaching tool like an information process framework, teachers, as Moore suggests, find it hard to know where to begin (op. cit., p. vii). It also suggests that a framework focused narrowly as a 'library-based' process will not highlight the crucial need for metacognitive, metalearning skills needed to 'use' information critically and creatively beyond the library walls.

Kuhlthau's study was seen as exemplifying many of the residual problems endemic in 'library-centred' information literacy teaching. Moore's study is valuable in depicting the difficulty of attempting to be both library-focused *and* learning-focused. It also relates to Kuhlthau's fourth challenge - whether teachers can themselves *design* constructivist information literacy learning strategies to enhance student learning. Secondly, can they *implement* these strategies within the constraints outlined above, ensuring that students construct *knowledge* from the information they retrieve? Moore suggests that they could do neither.

This highlights the need for the current study to acknowledge *contextual factors* within the *design* of the *learning*, not just see them as problems. Constructivist information literacy learning, if it is contextualised in the school's learning/ teaching programmes, must acknowledge the primacy of contextual determinants of this learning.

The value of these two studies is not just because they profess to be constructivist, but because they demonstrate weaknesses and problems to which the researcher's current study is similarly vulnerable. They signal what needs to be avoided, and what needs to be attempted.

## Vygotsky : the metaphor applied to learning design

The new framework must encourage teachers to examine consciously how these contextual considerations shape the 'knowledge construction *environment'*. Contextual considerations *are* the landscape. If they present barriers, the identification and resolution of the problem is both product and process of the learning. Constructivist information literacy learning is constructing knowledge *within* the context of the learning environment.

It is in bridging the gap between 'information pastiche' and meaningful learning that the concepts of constructivism have much to offer, not because any is new or unique to constructivism, but because they are collected under a common ontological and epistemological umbrella. Exploring this relationship of linked concepts provides a rich harvest of pedagogical design insights. It is necessary to get beyond the generalisations and 'slogans' and adopt, as Cobb suggests, a 'pragmatic approach' which acknowledges that:

> *...the various versions of constructivism... do not constitute axiomatic foundations from which to deduce pedagogical principles. They can instead be thought of as general orienting frameworks within which to address pedagogical issues and develop instructional approaches* (Cobb, 1994, p. 18).

He notes:

> *Students construct their ways of knowing in even the most authoritarian of instructional situations...*
>
> *(t)he critical issue is then not* whether *students are constructing, but the* nature *or* quality *of those socially and culturally situated constructions* (ibid., p. 4).

White sees Vygotsky's zone of proximal development (ZPD) providing for:

> *... something more than the social support that some today call scaffolding; it is not just a set of devices used by one person to support high-level activity by another.*
> *The ZPD is the locus of social negotiations about meanings, and it is, in the context of schools, a place where teachers and pupils may appropriate one another's understandings.* (1989, p. xii).

The ZPD notion of mediation provides a focus for *designing* the role for the teacher *and* the student in the learning process *within the broad learning context.*. This was a 'missing link' in the earlier 'library-centred' studies and in Kulthau's and Moore's studies. The teacher's role was earlier noted as a significant success variable by educators working in constructivist technology-enhanced learning environments. If students' ability to learn in sophisticated information environments is compromised by their lack of learning and self-regulation skills, there exists, a 'zone' of learning need, and a role for the teacher-as-coach to mediate learning in this zone - designing the teacher back into the learning.

What Vygotsky's work provides beyond this metaphor is the opportunity to consider several areas crucial to constructivism, information literacy learning and learning design alike. These include:

- mediation as the cognitive apprenticeship notion of coaching learner-centred learning; the role of direct instruction; the notion of setting students up with metacognitive and metalearning strategies to control and own their learning;
- culturally constructed knowledge complementing textualised information; the influence of prior (domain and procedural) knowledge; the situated and social nature of knowledge;
- social versus individual learning; the role of peers and group learning processes in negotiating meaning; the contribution of models and approaches like co-operative learning, reciprocal teaching and cognitive apprenticeship;
- the ZPD as a learning/teaching environment - the internal and external contextual and climatic constraints which influence the learner's control of the learning and the teacher's role in the learning and teaching;

- the need to design complex and authentic learning environments, defined as information-rich, technology-rich, cognitively challenging, focused on topics of interest and relevance to the learners, but which meet curriculum objectives.

Vygotsky recognised the need for mediation of what is a historically *and* socio-culturally situated body of knowledge. This recognition provides a simple but profound philosophical underpinning to a constructivist information literacy pedagogy. It paves the way to a recognition that mediation may be shared by pedagogic frameworks like the information process frameworks, by technology and software (for example, 'Jasper' videodiscs, 'Bubble Dialogue', or CFHs), by peer tutors and outside 'experts' as well as teachers. Within information literacy learning the ZPD expands to accommodate electronic and 'virtual' learning environments beyond the boundaries of the classroom and 'class' notion of one teacher and thirty learners. To be 'authentic', these environments need to acknowledge the complexity of the 'real' world they simulate; to provide for the complexity of learning in the 'real' world; they need to be designed carefully to promote constructivist learning (Jonassen, 1990).

## Design issues : mediation

The ZPD concept allows the teacher to contextualise the student's knowledge within what Newman, Cole and Griffin (1989) call 'the construction zone'. It allows the teacher and the students to *design* each information literacy learning experience as an environment with boundaries and constraints determined by the curriculum topic, student learning needs and abilities, and the information process. It offers opportunities for students to work individually, with peers, teachers, or outside 'experts', with opportunities for choice of learning style, pace and self-regulation.

It is the provision of *constraints* and pedagogic scaffolding that, potentially, turns the task from purposeless 'collectomania' into purposeful learning within a subject discipline.

Novak depicts constructivist learning as "a *complex* product of human meaning building capacities, cultural context and evolutionary changes in relating knowledge structures and tools for acquiring new knowledge" (1990, p. 2).

> *(C)omprehension involves the construction of meaning: the text is a preliminary blueprint for constructing an understanding. The information contained in the text must be combined with information outside of the text, including most prominently the prior knowledge of the learner, to form a complete and adequate representation of the text's meaning* (Spiro et al., 1991a, p. 27).

If a student has little prior knowledge of a discipline, will exposure to sophisticated information and sophisticated information retrieval and processing tools create the requisite schemas, heuristic, factual or conceptual bases for constructing knowledge? In Von Glasersfeld's mathematical/ scientific frame of reference, it may be true to say that "a thinking subject has no occasion to feel the intellectual satisfaction of having solved a problem, if the solution did not result from his or her own management of concepts and operations but was supplied from outside" (1991, p. xviii), but, as any PhD student will attest, it takes an extensive and deep knowledge of the domain *before* 'the problem' emerges. Resource-based learning is often the equivalent for the student of doing a PhD in an area in which they know little but are told to 'go and look it up' (Marland, 1977). The nature of the 'it' is crucially part of the ZPD - both domain and professional pedagogic knowledge of the teacher seem crucial in setting the student up for success.

Kuhlthau sees the definition of purpose and product as the library media specialist's prerogative, brainstorming being used to establish prior knowledge (1993a, p.12). The New Zealand course sees the definition of learning purpose, the use of brainstorming and discussion to establish prior knowledge, and the development of key questions, key

search words, and key concepts as integral to how the classroom teacher negotiates the process and links the students' prior knowledge into the formal curriculum (Gawith, 1998). While this elicits and shapes existing knowledge, course records show that it often fails to help students' contextualise their knowledge within the structured relationships of a subject discipline *domain.*; often it is construed as 'find *an* answer to *a* question'.

Many of the early resource-based learning projects failed to recognise the complexity of the process, and of the students' need for prior knowledge (Appendix 1 and see also, Brown, Campione, & Day, 1981; Perkins & Salomon, 1989). They failed to recognise that 'finding the problem' was just as difficult for most learners as finding and *interpreting* information (see also, Prawat, 1997). Many of the 'collectomania' efforts are based on the *students'* assumption that the problem is simple - it is to collect facts related to a topic - and on the simplistic assumption by teachers that bringing students and information resources and technologies together with a question or questions is sufficient to ensure growth of subject discipline knowledge through resource-based learning. Chan, Burtis, Scardamalia and Bereiter suggest that "(l)earning from text involves more than the comprehension of additional information; it involves active construction of new knowledge" and that "prior knowledge plays an important role..." (1992, p. 114). They studied the 'constructive cognitive activity of children listening to text' with a sample of 109 children, and conclude:

> ... *a path analysis showed that only constructive activity exerted a significant direct effect on learning... the main effect of prior knowledge is on constructive activity rather than on learning directly. The results are also consistent with the view that strategic knowledge is important for utilizing domain-specific knowledge in learning* (ibid., p. 115).

By providing stages, information process frameworks provide scaffolding for teachers and students. However, as Kuhlthau states, and as ten years of course records confirm, both frequently lack the required teaching/ learning skills. However, neither these frameworks nor the pedagogy embedded in current information literacy writings specify how the information located should be contextualised in subject discipline knowledge, or what is meant by 'using' the information collected, and how it relates to constructivist learning as "meaning making that involves acquisition or modification of concepts and conceptual relationships" (Novak, 1990, p. 15). The developer suggests that worst outcomes of the current New Zealand course are *fact retrieval versus conceptual learning* (Gawith, 1998).

## Design issues : knowledge versus information

In constructivist information literacy learning, both teacher and learner require an understanding that what is being constructed is understanding and *knowledge.* Novak comments on "a distinction between information and knowledge, in that information could be coded in binary units and shuffled almost any way, whereas knowledge has structure, a history of creation and affective connotations" (1990, p. 5).

The distinction between collecting disembodied facts on a topic, and relating 'facts' to existing schema and concepts, or what Jonassen calls 'structural knowledge' is fine but crucial (1993). Commercial librarians may construct information so that clients (domain experts) can construct knowledge. Students are novice clients, and need the mediation of *domain* experts to challenge and contextualise their assumptions, naive theories and beliefs, and to build the *affective* as well as cognitive, learning environment. The teacher's knowledge of the context, of the subject content, of how this topic is structured and relates to other curriculum past and future topics; why it is fascinating, is critical in mediating learning.

Driver recognises that while "(t)he core commitment of a constructivist position, that knowledge is not transmitted directly from one knower to another, but is actively built up

by the learner, is shared by a wide range of different research traditions related to science education", there are different interpretations even within science education. All reflect, to some degree "the problematic relationships between scientific knowledge, the learning of science, and pedagogy". She contends that "(a)ny account of teaching and learning science needs to consider the nature of knowledge to be taught" (1994, p. 5).

Unlike science, information literacy is not a subject domain or a recognised body of knowledge. As currently defined it is a state, with resource-based learning as the means. The nature of the knowledge to be taught includes, as Novak (1990) suggests, knowing about making meaning from information, making information into knowledge. What this *is* is easier to appreciate in terms of what it *is not*. It is *not* the 'Burkina Faso information pastiche' or Best's 'collectomania'. Morrison and Collins (1995) use Wittrock's model of generative learning because it "predicts that deep understanding (true knowledge construction) is more likely to occur when individuals actively transform information and integrate it into existing cognitive structures". They suggest that, by playing 'epistemic games' with the information, "learners *participate* in the information they have access to" (ibid., p. 43). However, information literacy is wider than learning for understanding. It must include, surely, a broad appreciation of how the world of information is structured; what information sources might be appropriate for particular learning purposes; selection and *rejection* of information; discriminatory use, scanning, sifting and synthesising?

The evolving model (Chapter 4) suggests that information literacy is a complex relationship of knowledge about information sources and resources, information technologies, information and cognitive skills, plus learning, metalearning and self-regulatory strategies. The relationship of teacher and learner within the knowledge construction environment is reflected in the metaphor of cognitive apprenticeship (Rogoff, 1990). The role of the teacher is to model and monitor information finding and knowledge construction strategies, and lead the apprentice towards a heuristic stance and cognitive control within the process of transforming subject domain information into knowledge.

This raises three issues: firstly, how one teacher, however skilled, can mediate 30 or more students doing individual projects and topics, and secondly whether New Zealand primary teachers who are usually generalists without 'subject' degrees, have sufficient subject domain knowledge over several curriculum areas to meet this *domain expert* criterion. Thirdly, do they, themselves have the level of information literacy knowledge required? Moore suggests they do not.

**Design issues : social versus individual learning**

The existence of an information 'out there' embodied in 'articulated' knowledge stored in print and electronic media, and people, poses an apparent contradiction to the radical constructivists' position which sees knowledge as constructed in the head of, and specific to the individual (von Glasersfeld, 1991). Von Glasersfeld dismisses "the naive commonsense perspective, (that) the elements that form this complex environment belong to a *real* world of unquestionable objects, as *real* as the student, and these objects have an existence of their own, independent not only of the student but also of the teacher (ibid., p. xv). This is defensible from an ontological perspective, but flies in the face of *reality*. 'Articulated' knowledge and its relationship to knowledge construction lie at the heart of constructivist information literacy learning. Candy says "(i)n recent years, the term information literacy has come to stand for a cluster of abilities that are required to cope with, and to take advantage of, the unprecedented amounts of information which surround - and at times overwhelm - us in our daily lives" (1993, p. 60). Novak points out, "(i)t is important to recognize the distinction between constructivism as a psychological belief and constructivism as an epistemological belief" (1990, p. 3).

Cobb argues in relation to mathematical learning that it "should be viewed as both a process of active individual construction and a process of enculturation into the mathematical processes of wider society" and sees the need "to explore ways of

coordinating constructivist and sociocultural perspectives in mathematics education" (1994, p. 13). Likewise, Driver et al (1994, p. 5) talk about "apprenticeship into scientific practices", "the knowledge-construction process as coming about through learners being enculturated into scientific discourses". For Kuhlthau it might be enculturation into library-based discourses, while classroom teachers might see it as learning to think like a historian or physicist. The clash of ontologies has profound implications for the learning designed.

The proliferation of information, information sources, information technologies and the increased sophistication of the necessary cognitive and information skills, in itself represents an *evolving,* challenging cross-disciplinary knowledge domain central to the 'information society', into which *teachers* as well as students need enculturation.

Learners (teachers and students) need to challenge the assumptions and given cultural and social 'truths' embedded in information. Students' frequent assumption that because it is computer-based it is 'true' needs addressing. The knowledge that learners construct from information by analysing, thinking, and comparing interpretations with the teacher, with each other and with 'experts' (whether those experts are long dead and their views embodied in text, or live experts via the Internet or phone, video- or audioconference) is individually, socially and culturally contextualised. It is individual insofar as any experience is unique to the experiencer, and this is no different for the experience of text. It is social in the sense that the experience is situated in the social context of the school, curriculum, classroom, virtual electronic classroom. These are, inevitably, socio-cultural constructs, representing the values and meanings of a particular society and cultural group.

Resnick sees most knowledge as "an interpretation of experience, an interpretation based on schemas, often idiosyncratic at least in detail, that both enable and constrain individuals' processes of sense-making" (1991, p. 1). But, as Vygotsky and Wertsch claim, "the very representations available to the lone individual facing a cognitive task will have been socially shaped" (ibid., p. 8). She adds "(c)ognitive tools embody a culture's intellectual history; they have theories built into them and users accept these theories - albeit often unknowingly - when they use these tools"; that:

> *What individuals reason* about, *the knowledge they bring to a cognitive task, provides the interpretative frames or schemas that allow reasoning and problem solving to proceed... These beliefs, individuals' schemas for reasoning, are not purely individual constructions. Instead they are heavily influenced by the kinds of beliefs and reasoning schemas available in the individuals' surrounding culture* (ibid., pp. 7 - 8).

**Design issues : designing a learning environment**

It is in designing explicitly constructivist learning environments that many traditional instructional design models and principles are being challenged as new principles emerge. Many of these emerging principles conflict with traditional instructional design principles, particularly in relation to negotiation, authenticity, and the teacher's role. Understanding the constraints of traditional instructional design (ID) and its conflict with constructivist ontology, epistemology and pedagogy, is useful for understanding how the evolving principles of designing (constructivist) learning can inform the CILL model and pedagogy.

**Instructional design (ID) and Designing Learning (DL)**

In dialogue in issues of *Educational Technology*, and recent books (for example, Duffy & Jonassen, 1992a; 1992b) two trends have emerged. The first is the introduction of constructivist aspects into traditional practices of instructional design. The second is the

emergence of significantly different, specifically constructivist approaches to designing learning.

Both trends are significant for the design of information literacy learning because both *design in* more learner control and consciousness of the learning process. The issue it raises for the constructivist designer is how much control is enough? How much control for the learner; how much for the teacher? Morrison and Collins' (1995) 'epistemic games', for example, are excellent strategies conceived within a constructivist framework for enhancing learning, but applied systematically across, say, a whole class, they risk becoming as prescriptive and inflexible as any traditional ID-derived instruction. Jonassen claims, in any case, that teachers are ill-equipped to cede control to learners and learners are ill-equipped metacognitively to take control:

> *Poor study skills and ill-developed study schemas in learners at all levels militate against the implementation of these environments. Moreover, the environments call on study strategies that directly conflict with the well-rehearsed, habituated study skills of learners* (1993, p. 37).

In asking "Who should be the designers?" Banathy raises another important issue (1991, p. 49). He outlines four generations of design approaches, from 'systems engineering methods', to 'social systems', to the 'consultant/ expert' who uses the 'designing with', and finally the 'designing within' approach which he sees as authentic and sustainable. This participative approach is commensurate with a constructivist approach, but it raises the issue of teachers' current approaches to planning, and the changes that might be required of them. Banathy states that it requires "expertise in the intellectual technology of systems design" (ibid., p. 51).

In recent years international studies on teacher planning have proliferated. Their findings are remarkably similar. Experienced teachers do considerable mental but little written planning, and few start with objectives. Earle (1994)) comments that very few teachers or teacher educators read instructional design literature. There is consensus in the literature that ID models have not been adopted to any great degree by teachers. Teacher education ID models and programmes have been developed (Branch, 1994; Driscoll, Klein, & Sherman, 1994; Earle, 1994; Gustafson, 1993; Kennedy, 1994; Reusser, 1996). However, studies by Martin (1991) and Kennedy (1994) show that, even when teachers had training in ID, it was seldom applied regularly and systematically. Driscoll, Klein & Sherman (1994) comment that the thinking of teachers appeared different from the thinking of designers. This illustrates Banathy's point (above) that designing *for*, or even*with,* needs to be superseded by designing *within.* Gustafson says "what we need are alternative ID paradigms that more closely match the goals and purposes of K-12 education and the reality of how it is organized and functions" (1993, p. 29).

There is consensus in the literature that the origins of instructional design (ID) lay in behaviourism (Cooper, 1993; Dick, 1995; Lowyck & Elen, 1991, p. 213; Winn, 1991a). There is also consensus that the "cognitive shift in learning psychology implies the reconceptualization of ID" (Cooper, 1993; see also, Lowyck & Elen, 1991, p. 213 ; Winn, 1991a, p. 38). This shift from behaviourism to cognitivism was evolutionary, with an increased emphasis on making provision for individual learner differences (for example, Tennyson, 1990), for 'control' in the form of greater learner choice (for example, Landa, 1983, p. 163; Merrill, 1993, p. 279; Nervig, 1990; Reigeluth & Stein, 1983, p. 335), and incorporating affective dimensions of learning, like motivation (for example, Main, 1993, p. 37).

Andrew and Goodson analysed more than 40 ID models, suggesting that most fit on a continuum between behaviourist and cognitivist (cited in Kennedy, 1994, p. 17). While some see ID accommodating the subsequent shift from cognitive to constructivist paradigms (for example, Winn, 1993, p. 16), others see it as a fundamental paradigm shift, a revolution (for example, Willis, 1995; Jonassen, 1990, p.32). Willis says "While

there are real differences within the behavioral (or objectivist or rationalistic or technical-rational) family of theories, they all share related philosophies of science that are objectivist, rational, and empiricist or postempiricist", and suggests the need for "an alternative instructional design model" (Willis, 1995, p. 5). Reigeluth defines instructional design in terms of the 'linking science' postulated by Dewey, linking learning theory and educational practice:

> *Instructional design is this linking science - a body of knowledge that prescribes instructional actions to optimize desired instructional outcomes such as achievement and affect* (1983, p.5).

The question pertinent to this study is whether the emerging constructivist design insights better inform the design of constructivist information literacy learning than 'traditional' ID. Banathy's description, "(i)n search of a new wineskin for the new wine" is apt (1993, p. 33).

"ID has become a 'systematic' way of making instructional decisions, not a 'systemic' way of looking at learning" (Winn, 1991b, p. 193). The distinction between systemic and systematic is significant because it results, in traditional ID, in an emphasis on "instructional management rather than on learning" (ibid., p. 193) and the design of linear instructional sequences. "(T)he entire ISD process is systematic in that each step flows from the previous one" (Dick, 1993, p. 12).

When constructivist thinking is applied to ID the emphasis shifts from designing systematic, prescriptive instruction to designing learning. Jonassen (1994, p. 35) says "(c)onstructivists emphasize the design of learning environments rather than instructional sequences". This marks a shift from teacher-centred instruction to learner-centred learning, a shift echoed in the shift from teacher-directed, behaviourist resource-based teaching or 'bibliographic instruction', to student-centred, constructivist information literacy learning.

Savery and Duffy summarise, with reference to other constructivist writers, 'instructional principles deriving from constructivism' within a problem-based learning model, using Lebow's 'seven primary constructivist values', *collaboration, personal autonomy, generativity, reflectivity, active engagement, personal relevance and pluralism.*(1995, p.32). These principles are compatible with the summary of general attributes of constructivist learning produced by Jonassen and Cunningham (1994, p. 37): *negotiation* ('internal' and 'social') of real world environments which provide *authentic, meaningful contexts* for learning which stimulate *reflection.* The teacher's role is seen as crucial in negotiating, coaching and providing scaffolding and support.

Jonassen (1995, p. 62) describes seven "qualities of meaningful learning based on constructivist cognitive apprentice assumptions." This learning is active, constructive collaborative, intentional, conversational, contextualised and reflective. He compares what it is with what it is not:

- knowledge construction, not reproduction;
- conversation, not reception;
- articulation, not repetition;
- collaboration, not competition;
- reflection, not prescription.

He asks " if we accept some of the tenets of constructivism how do we adapt our models of design to foster 'constructivist learning?'" (1994, p. 35). This comparison provides a useful focus for analysing the characteristics of 'objectivist' instructional design in relation to constructivist requirements for designing learning. It highlights the contrast

between constructivist learning and the type of learning designed in traditional ID. This learning tends to be everything that constructivist learning is not:

- it tends to be concerned with *reproduction* not interpretation and transformation. It tends to be reductionist and ignores the systemic complexity and contextualisation of learning (Jonassen, 1990, p. 33; Lowyck & Elen, 1991, p. 103; Merrill, Zhongmin, & Jones, 1990, p. 7; Winn, 1991b).
- it tends to emphasise learning as *reception* - passive, deterministic, single perspective, hierarchical (Jonassen, 1990, p. 33; Lowyck & Elen, 1991, p. 103).
- it tends to emphasise *repetition* of the same instructional methods until the outcomes predetermined by the objectives are reached; it is prescriptive and procedural (Jonassen, 1990, p. 33; Kember & Murphy, 1990, p. 43; Leskin, Pollock, & Reigeluth, 1992, p. 1; Lowyck & Elen, 1991, p. 103);
- it is predicated on a model of *competitive* individualistic learning (Leskin et al., 1992).
- it tends to emphasise performance on linear sequence of *prescribed* tasks more than cognition and reflection; an overemphasis on procedure rather than why to do it (Jonassen, 1990, p. 33; Kember & Murphy, 1990, p. 43; Leskin et al., 1992, p. 1; Lowyck & Elen, 1991, p. 103).

It also describes the approach to learning that characterised many of the early RBL/ bibliographic instruction studies, and, as such, has explanatory value.

Jonassen suggests that traditional instructional systems [IST] "cannot explain the complexities of human learning, especially knowledge-based learning" (Jonassen, 1990, p. 32). He adds "the primary difference, we believe, between constructivist and objectivist approaches to the design of instruction is embodied in the learning vs instruction distinction" (1994, p. 35).Because the nature of the learning is different, the nature of the design process is different.

Substituting the term 'learning design' for 'instructional design' would seem an appropriate reinforcement of the paradigm shift.

**Design issues arising from the ID/DL dialogue**

Jonassen (1993) and Dede (1995, p. 46) describe complex interactive, distributed, synthetic, constructivist, 'virtual' environments, replete with what Jonassen calls cognitive amplification toolkits for what Dede describes as "using virtual artifacts to construct knowledge". The potential is immense. What lags behind is our capacity to design for learning and teaching within these environments. Not least is the paucity of good models and protocols to design this learning, and examples of good practice.

From the 'dialogue' (Duffy & Jonassen, 1992b) between 'constructivist learning design and traditional instructional (systems) design' groups, a focus on **assessment** emerges as one of the key issues relating to constructivist approaches to learning design (Allen, 1992, p. 187; Cooper, 1993, p. 17; Duffy & Jonassen, 1992b, pp. 9 - 13; Entwistle, 1991, p. 353; Jonassen, 1991; 1993, p. 37; Reigeluth & Garfinkle, 1992, p. 21). It is one of the key issues to be resolved in the design of the CILL Framework because it is also germane to the New Zealand curriculum, particularly as the ongoing, incisive National Education Monitoring Programme is providing disquieting evidence about students' comprehension and information skills five years after the implementation of the constructivist-oriented 1993 national curriculum (Crooks & Flockton, 1997; 1998).

Another emerging issue is designing learning for **transfer**. While, as Tobias points out, it is at the heart of the "Constructivist-ISD controversy", he also points out that it is an issue with many problems and few answers, quite irrespective of the positions of

adherents to various paradigms. He claims that "(t)he constructivist position assumes that transfer can be facilitated by involvement in authentic tasks anchored in meaningful contexts" (see also, Merrill, 1992; 1992, p. 207). However, as suggested previously, there is a paucity of rigorous research and the CTGV researchers themselves) see transfer as an issue needing more research attention (Cognition and Technology Group at Vanderbilt, 1994a p. 199; Greeno, 1997, p. 11). Also emerging as an issue is the danger of constructivist design as a 'rhetoric of empowerment' (Brookfield, 1993, p. 23).

The recorded results of resource-based learning instruction, did not mirror the rhetoric (for example, Kirk, Poston-Anderson, & Yerbury, 1990). The expectation that bringing learners and information resources and technologies together will ensure autonomous, self-directed learning is naive. If the reality of the learning is to mirror the rhetoric, a constructivist approach to information literacy needs to change this expectation in the way the learning is designed.

**Constructivist learning design characteristics;**

- There is an emphasis on designing learning *environments* rather than prescriptive learning sequences for individual learners. These are complex, authentic environments, often project or problem-based, providing multiple perspectives, context-rich, experience-based knowledge construction opportunities (Berliner, 1992, p. 10; Cognition and Technology Group at Vanderbilt, 1991c; Duffy & Cunningham, 1996; Hawkins & Collins, 1992; 1996; Jonassen, 1991; 1994; 1995; Morrison & Collins, 1995; 1991a; Perkins, 1991b; Savery & Duffy, 1995; 1991a; Spiro et al., 1991b).
- Learning within these environments is *student-centred, contextualised* (in relation to external contexts like curriculum, learning styles, abilities, interests and internal contexts like self efficacy, self regulation, motivation), and emphasises *learner control,* socially constructed knowledge, dialogue, multiple perspectives and negotiation of meanings. (Bagley & Hunter, 1992; Chung & Reigeluth, 1992; Cognition and Technology Group at Vanderbilt, 1991a; Cooper, 1993; Dede, 1995; Jonassen, 1994; 1991a; Spiro et al., 1991b; Wagner & McCombs, 1995).
- Learning is *authentic* - situated in relevant, interesting, problem-based situations which relate to students' prior knowledge and promote reflective, recursive, multiple perspective thinking and discussion, and the use of metacognitive and metalearning strategies (Berliner, 1992; Cognition and Technology Group at Vanderbilt, 1991a; Duffy, In press; Morrison & Collins, 1995; 1991a; Perkins, 1991b; Savery & Duffy, 1995; Spiro et al., 1991b).
- There is agreement, that, in line with the learner-centred nature of the learning, the role of the teacher changes from 'instruction' to what is variously called *coaching, guiding, mediation, facilitation.* (Allen, 1992, p. 187; Berliner, 1992; Chung & Reigeluth, 1992; Duffy & Jonassen, 1991, p. 9; Hawkins & Collins, 1992; Savery & Duffy, 1995)
- While there is considerable enthusiasm about the learning potential of these constructivist learning environments, a few writers agree about the considerable *demands they make on learners and teachers* (Cognition and Technology Group at Vanderbilt, 1994a, pp. 199-200; Dede, 1992, p. 54; Lamon et al., 1995; Perkins, 1991b).

The extent to which students are able to control the learning is influenced by the extent to which the teacher is able to teach the cognitive and metacognitive skills to help the student construct knowledge (Duffy, In press; Lee & Kazlauskas, 1995). Howard (1989) sees information and knowledge on a continuum with the teacher as middle ground. The teacher's role is to ensure that students understand the process and can employ the cognitive and technological skills to control the process, using the teacher as a knowledge

resource (Wirth, 1994). Brown highlights some of the challenges: when the learning environment is opened up to much greater learner control:

> ... *two problems surfaced within the programme, as they have elsewhere, when project teams were working with teachers and pupils in this vein. Firstly, higher learner control works well with some pupils rather than others, depending partly on ability and motivation but also upon their approach to learning when using IT. The other problem is that even potentially very powerful applications do not lead to spontaneous development of problem solving or other general thinking skills. These only work effectively if they are embedded in powerful teaching-learning environments. This then requires much more than 'plugging in' a relevant IT application. In particular, the quality of support, whether from teachers, written materials or on-line help, becomes critical* (1994b, p. 149).

Several constructivist writers see a role for *direct teaching* (Cognition and Technology Group at Vanderbilt, 1993a; Crook, 1994; Perkins, 1991b, p. 20; Winn, 1994, p. 12). A few are specific about *what* needs to be taught. For example, Fiske (1991) and Graesser, Person and Huber (1993) see a crucial role for the teacher in developing *questioning skills*. Morrison and Collins suggest a range of 'epistemic games' for actively *transforming information into knowledge* (1995). *Critical thinking skills* need to be modelled in the context of the particular learning experience (Bagley & Hunter, 1992; Brown, 1994b, p. 149; Dede, 1992, p. 54; Dick, 1991, p. 41; Glaser, 1993, p. 91).

Simplistic assumptions that direct teaching applies only in 'drill and skill', rote learning and teacher-directed learning environments are clearly inappropriate. Perkins (1991a, p. 20) discusses BIG and WIG learning environments. For the learner to go **b**eyond the **i**nformation **g**iven or **w**ithout the **i**nformation **g**iven requires both ability and willingness to use complex cognitive skills and processes. However intrinsically challenging, motivating and compelling the learning environment and the technology, if the learner does not have the requisite skills (basic literacy and numeracy as well as thinking and metacognitive skills) the learning will be compromised (Beswick, 1987; Wirth, 1992).

Three recent frameworks for designing constructivist learning accommodate the 'control, context, coaching' assumptions outlined in Chapter 4. They are:

**Jonassen's** (1995, p.61) model with 'seven qualities of meaningful learning,' *active, constructive, collaborative, intentional, conversational, contextualized* and *reflective* is designed to incorporate these elements to enhance the use of technology in constructivist learning.

**Willis's** (1995) 'R2D2' model has three focal points, *1) define, 2) design and develop, and 3) disseminate* , and it emphasises *recursion* and *reflection.*

**Savery and Duffy's** (1995) constructivist model incorporates the following guidelines:

1. *Anchor all learning activities to a larger task or problem,*
2. *Support the learner in developing ownership for the overall problem or task,*
3. *Design an authentic task,*
4. *Design the task and learning environment to reflect the complexity of the environment they should be able to function in at the end of the learning,*
5. *Give the learner ownership of the process used to develop a solution,*
6. *Design the learning environment to support and challenge the learner's thinking,*

7. *Encourage testing ideas against alternative views and alternative contexts, support reflection on both content learned and learning process.*

## Designing the CILL Framework

> *As with any instructional design model what is ultimately significant will be the efforts to develop an integrated set of recommendations linking content, learners, and methodology... A danger associated with venturing into eclecticism is that one will abstract elements which are contextually dependent for their efficacy upon being present in the original theory or model* (Clark, 1994, p. 38).

Mindful of the dangers of eclecticism, the framework is designed within two guiding parameters: its purpose and function, and its grounding in constructivism

### Purpose and function

The purpose of the framework is to provide teachers with a *tool for integrating constructivist information literacy learning into classroom programmes*, acknowledging normal school/ classroom constraints.

Experience suggests that few teachers can design and implement constructivist information literacy learning without, themselves, having been part of a learning community and *experiencing* this kind of learning; exploring the rewards and challenges of 'doing it with' instead of 'doing it to' students. Duffy (In press, p. 4) says "Rather, the change must arise from... (teachers') own construction of a model of learner centered teaching and from a collaborative environment in which they can test their constructions, evaluate alternative perspectives and reflect on their own teaching." In line with Jonassen's (1994, p. 35) comment that "(c)onstructivists emphasize the design of learning environments rather than instructional sequences", the explicit purpose of the framework is NOT to provide a planning tool that teachers can use to design information literacy lessons for , but to provide a tool for teachers to design a *learning environment* WITH *students*.

Winn talks about recent ID approaches as 'message design'(1993, p. 19). The message the CILL Framework is intended to emphasise is the need for teachers to design a learning environment in which students can not only find and present information, but work collaboratively with the teacher toward *self-regulated knowledge construction and metalearning*; in particular toward:

- *Taking the initiative, with or without the help of others, in diagnosing or assessing... own learning needs.*
- *Selecting appropriate sources of help with learning, and where necessary, temporarily surrendering some measure of independence for the sake of expediency in learning.*
- *Developing, through a process of inquiry and reflection, an appreciation for the criteria by which to evaluate the particular domain of learning being undertaken.*
- *Continually reviewing the process of learning (as both cognitive and a social phenomenon), and making strategic and tactical adjustments... in order to optimize learning potential* (Candy, 1991, p. 134) .

Banathy's comment is pertinent:

> *The "designing within" approach is based on the assumption that to be authentic and sustainable, human activity systems must be designed by those... who use them, and who are served by them. Design cannot be legislated. It should not be bought from experts, If the privilege and responsibility for design is given away, others will take charge of our lives and the shape of our futures* (1991, p. 50).

New Zealand's information process course is perceived as successful (Ministry of Education, 1993b). However, the design *is* legislated, and it *is* bought from 'experts'. This new framework represents the challenge to give 'the privilege and responsibility for design' to teachers and students.

A designer does not design a house without knowing what a house is; in order to design constructivist information literacy learning, teachers need to know what it is. The design tool is not pen and paper or computer: It is the contextualised knowledge of this type of learning. Without this knowledge, it is unlikely that teachers will have tools adequate to the task, and it is likely to be made even more difficult because the students, are no more likely to understand constructivist information literacy learning, and quite likely to bring negative or positive associations of library lessons and 'look-it-up collectomania projects' to the exercise with all the resentment that is brought to bear when anyone tries to change anything they do, well *or* badly! (for example, 1987; Baird & Northfield, 1992; Candy, 1991, p. 372).

There is no obvious solution to the dilemma. What the framework will attempt to do is to use constructivist design approaches to design a pedagogy from a base of experienced knowledge of information literacy, in the hope that teachers will move *toward* an understanding of constructivist information literacy learning, and take their students with them - a journey, not a destination. It is not anticipated that teachers will use the framework, in its entirety, but use it flexibly and selectively, employing a range of teaching approaches.

**Grounded in constructivism**

Candy (1991, p. 322) comments that there are literally hundreds of approaches to teaching that are alleged to result in enhanced capacities for learning in general and self-directed learning in particular. While, as has been demonstrated, information literacy learning draws on sociocultural, discovery, experiential and generative learning paradigms, it emphasises *re*-construction not reproduction of knowledge; what Candy calls "(t)he constant dialetical interplay between construing and constructing; how learners *construe* (or interpret) events and ideas, and how they *construct* (build or assemble) structures of meaning" (ibid., p. 272). The clay of this re-construction is information - Laurillard's 'articulated knowledge' (1993, p. 25) Vygotsky's 'systematic knowledge' (1962, p. 82) , Jonassen's 'structural knowledge' (1996; 1993); a society's 'symbolic meaning structures' embodied in print and electronic texts, in media, in people (Candy, 1991, p. 269).

Banathy asks '(w)hat core values and core ideas should guide us in (a) creating a vision, (b) based on it, forging a new image of education, (c) and designing new systems of learning and human development that will bring the image to life?' (1991, p. 50). The vision here is broadly constructivist (as opposed to narrowly constructivist in the tradition of radical constructivism, social constructionism, and the like). The core values and core ideas reflect the notion of empowering learners by giving them the cognitive and affective learning tools and environment to control their own learning. Kohn says "(t)he entire constructivist tradition is predicated on the idea of student autonomy, which is to say, the chance for students to view learning as something "under their control rather than as disembodied, objectified subject matter" (1993, p. 13). "'Learner centeredness' provides a conceptual framework for describing how a learner understands his or her world and approaches the process of learning inside and outside the classroom" (Wagner & McCombs, 1995, p. 32).

The choice of a broad approach to constructivism sets the Framework within what is a generally familiar 'progressive' paradigm accepted, at least in theory, by most New Zealand teachers (McGee & Fraser, 1994). It is characterised by what Whitaker (1995, p. 9) calls 'new paradigm assumptions'. These, because they are general, apply equally to

traditions other than constructivism. Herein lies their value as conceptual bridge builders. They include:

- *Emphasis on learning how to learn;*
- *Learning as a process, a journey;*
- *Flexible structures, varied starting points, mixed learning experience;*
- *Priority given to the self-concept as the key determinant of successful learning;*
- *Use of the pupil's inner experiences as contexts for learning;*
- *Guessing and divergent thinking encouraged as part of the creative process;*
- *Teacher as learner too, learning from the pupils* (Whitaker, 1995, p. 9).

Breadth does not automatically imply 'woolliness'. Constructivism is no more or less 'woolly' than any other approach to learning. Candy points out that, paradoxically, the less learners are accustomed to autonomous learning, the more direction and support they will require to become autonomous (1991, p. 37). The theory base of the framework is broad, the focus is on learners, learning, choice and negotiation, but the intention is to provide for clarity on the part of framework users; to design for "(l)earner control, learner experience, learner definitions of meaning and reality" (Richey, 1993, p. 20).

## Design principles

Jonassen describes the key characteristics of what he calls knowledge construction environments. They are learning environments which:

- *provide multiple representations of reality, thereby:*
- *avoiding oversimplification of instruction by representing the natural complexity of the real world;*
- *focus on knowledge construction, not reproduction;*
- *present authentic tasks (contextualizing rather than abstracting instruction);*
- *provide real-world, case-based learning environments, rather than pre-determined instructional sequences;*
- *foster reflective practice;*
- *enable context- and content-dependent knowledge construction; and*
- *supporting collaborative construction of knowledge through social negotiation, not competition, among learners for recognition* (1994, p. 35) .

Jacobson and Jacobson's three major themes in 'representative cognitive learning theories' include situated cognition and cognitive flexibility theory; they complement Jonassen's characteristics and reflect information-based learning:

- *Active role of the learner in constructing her or his own knowledge*
- *Importance of learning in knowledge-rich contexts*
- *Theory and research based on characteristics of competent or expert performance* (1993, p. 129).

Jacobson and Jacobson's list of themes characteristic of situated cognition reinforce Jonassen's characteristics and the notion that constructivist learning is situated:

- *knowledge-rich, authentic situations;*
- *modeling; coaching and scaffolding;*
- *fading;*

- *collective problem solving;*
- *display multiple roles;*
- *articulation, reflection, and confronting misconceptions;*
- *collaborative learning* (ibid., p. 129).

The review of success (and failure) factors in existing RBL/ TBL research and practice indicated characteristics of effective information literacy learning:

1 Learning set in the **context** of rich and complex *learning environments,* authentic in the sense of being relevant to societal, educational, curricular, classroom conditions and constraints, student interests and needs

2 Learning *mediated* by targeted teaching, modelling, **coaching,** guidance or scaffolding provided by the teacher, peers, experts, learning environment, resources, software

3. Learning 'owned' by learners; **control** achieved through help with the required (but seldom taught) learning, thinking, metacognitive, metalearning, self-efficacy, self-regulation and planning skills.

These three characteristics are consonant with constructivist learning characteristics outlined above; they are also consonant with the recent models for designing constructivist learning discussed above. However, as suggested previously, the pedagogical implications are daunting. There is a need to address the consensus concerns emerging in constructivist literature, particularly with regard to:

- **transfer** of learning
- **assessment** of learning
- **entry level** required of learners (prior knowledge and learning competence)
- **skills** and knowledge required of the teacher

The assumptions tested in Chapter 4 have been translated into cornerstones in the CILL model of constructivist information literacy learning.

The cornerstones are deliberately alliterative and depicted as a simple triangle of interrelationships because the model is intended to have mnemonic value and to be used as a simple theoretical 'anchor' to structure the pedagogical propositions of the framework.

Within the CILL trial the model is intended to be used by teachers as a starting point for discussion of information literacy learning. It depicts, in shorthand, the contextualised roles of the learners and teacher-coach in information literacy learning. If teachers agree, at least in principle, that information literacy learning should be set in the *context* of the curriculum, focussed on helping students to learn to *control* their own learning, and that their role includes *coaching* , they will be working from a constructivist philosophy, irrespective of what they choose to use from the framework and how they choose to use it. The cornerstones also provide a trigger for re-grounding teachers' thinking in these focal principles during the research process. This simple model is, therefore, envisaged as the keystone in the framework, anchoring it to its theoretical underpinnings which are represented in the ten pedagogical propositions.

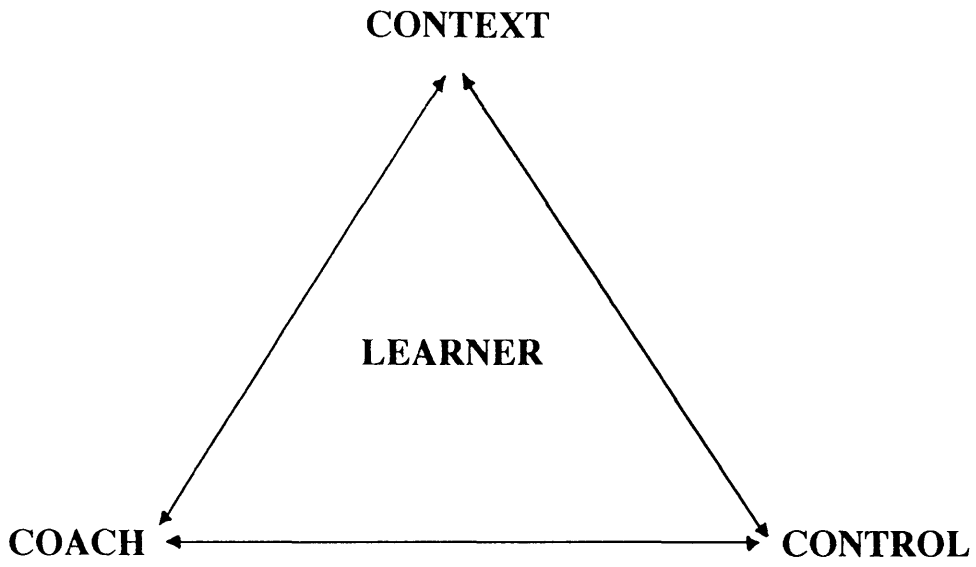


**Fig 4: Model of constructivist information literacy learning**

**Pedagogical propositions**

1. information literacy learning is contextualised within a learning environment;
2. information literacy learning is authenticated by designing a learning environment;
3. ownership of the learning is established;
4. knowledge needs are defined;
5. information selection is guided / monitored;
6. skills are employed strategically for working with information;
7. metacognitive/ metalearning strategies are used to construct knowledge from information;
8. knowledge can be produced and communicated;
9. construction of knowledge and communication of knowledge can be self-assessed and collaboratively assessed;
10. control of learning can be evaluated.

**CILL FRAMEWORK**

This framework is built around these ten propositions, introduced to teachers through a discussion of the propositions.

The overview of the propositions is followed by an explanation of how the three cornerstones, context, control, coaching, make this framework different from its predecessors. Three narrative maps provide a graphic expansion of the cornerstones. The propositions and narrative maps, along with an explanation of constructivist information literacy learning, and prompts to guide the teacher, comprise the first draft of the CILL

Framework teachers' booklet used in Teacher Cycles A and B, and the revised version used in Cycles C and D (see Appendix 2,3,4).

The teacher's role has ten prompts; the student's role has three main cycles - planning, learning and reflecting. There are checkpoints for getting and giving feedback built in at each of the ten prompts providing the structure for collaborative, reflexive and recursive approaches, and for the teacher's coaching function to be scaffolded by the iterative nature of the steps within the stages. The framework provides the scaffold; the prompts encourage the teacher to treat students like participants in action research, using their own learning as the data for collaborative analysis through 'reflective conversations'.

The CILL Framework differs from its 'information process' predecessors:

**Context**

The CILL Framework places significantly more emphasis on the teacher's need to work with students to contextualise the learning, not only in relation to prior knowledge, but in relation to the conceptual structure of the subject discipline, how it reflects past and future curriculum emphases, and also in relation to learners' self-efficacy, skill and will.

**Control**

The CILL Framework integrates the information finding, selecting and 'interviewing' stages of the 'information process' into the planning (to learn) phase. Interviewing information and working with information become distinct steps emphasising the need to construct knowledge from information and to avoid information-pastiches.

It introduces the concept of a *heuristic framework.* This acknowledges the need for students to be able to develop and refine *key questions. Key search terms* and keywords are also needed for finding information and for skimming and scanning. Students also need to be able to articulate *key concepts* - the reasons why it might be important/ interesting to learn about this topic. The heuristic framework grows out of the learners' categorisation and 'mapping' of the topic. It focuses and filters subsequent information searching, selecting and rejecting and is the starting point for *interviewing the information.* 'Reflective conversations' with peers and coach help to shape knowledge, using the heuristic framework as a focus. It structures the way knowledge is communicated, and forms the focus for forming the criteria by which the learning is evaluated. It is the gear system which students use for iterating through the phases, constantly looping back to their key questions, key terms and key ideas, adding and amending.

**Coaching**

The CILL Framework reflects the strong support for the idea that learners with weak self-efficacy will not be able to, or want to, control their learning. By integrating a focus on self-as-learner at props 1 and 10, the coach helps the student to develop self-efficacy over time. The student is helped to self-diagnose needs and talk the language of learning skills and strategies.

A 'get and give feedback' checkpoint as a prompt for teachers between each of the ten propositions or 'props' reinforces the idea that monitoring and evaluation MUST be ongoing if students are to feel a sense of control and ownership, and learn metalearning language and strategies. The checkpoints will be the catalyst for the 'reflective conversations' which are the coach's primary strategy for encouraging students to articulate what has been done, and how, and for 'cognitive rehearsal' of what follows.

The CILL Framework is suitable for teachers to use to plan a learning environment based on people as information sources, or, where students have home or classroom access to

the Internet, learning based on global information sources, or, where time, technology and expertise allow, the creation of sophisticated environments like 'Jasper', CSILE or SFT, or even classroom-based environments using software like Bubble Dialogue where the information source is the students' own ideas and opinions.

The challenge is the fine balance between simple and simplistic; the tension between a clear, useable framework which acknowledges but is not distorted by the teacher's lack of time for planning, lack of familiarity with the theory of constructivism, and lack of experience of information literacy learning, lack of experience with technology, and lack of experience, as a learner, of learning in information and technology enhanced complex generative constructivist learning environments.

The working documents for the propositions and the first and second versions of the CILL Framework are reproduced in Appendix 3 and 4.