CHAPTER FOUR

PHASE ONE: CONSTRUCTION OF THE BARS-EL RESULTS AND DISCUSSION

The chapter is divided into seven sections and for clarity and continuity, presents and discusses the results of Phase One in its entirety. The first four sections deal specifically with the first four stages of the Hybrid BARS process. In the fifth section, the BARS-EL developed by the Hybrid BARS process is discussed. The sixth section presents the findings and implications of Phase One of the study, while concluding comments are provided in the seventh section.

4.1 STAGE 1 – FORMATION OF THE EXPERT PANELS

As described in Chapter Three, central to the Hybrid BARS process was the formation of two expert panels whose purpose was to identify the performance dimensions and competencies for e-learning. The identification of participants and the formation of the two expert panels was the primary activity of Stage 1 of the Hybrid BARS process.

4.1.1 Identification of student participants

Two students from the School of Education were prepared to be members of the expert panels. The first student was studying in the Bachelor of Education (Primary) program at the undergraduate level. The second student was studying in the postgraduate Master of Education program specialising in Computer Education. Although broader faculty representation by students would have been preferable, this was not possible.

However; the two students selected were:

- able to provide an undergraduate and postgraduate perspective on e-learning;
- skilled computer users;
- successful candidates of an OL3 online unit.

As such, both students were considered 'expert' as they were judged to have had "extensive knowledge, familiarity, expertise, or previous experience with the criterion job or task" (Anshel, 1995, p. 14).

4.1.2 Identification of staff participants

A total of 43 university staff members were identified as potential expert panel participants. From this pool of potential participants, 12 staff members were selected based upon their willingness to participate in the study and their availability for the expert panel workshops. Despite attempts to create panels with the composition as indicated in Table 3.4, in two cases this was not possible. Firstly, due to work commitments, the Adult Education and Higher Education academics both had to serve on the same panel rather than different panels as was preferred. However, despite the desirability of having a consistency of expertise across the two panels, diversity of panel membership is the most critical factor for success in the Hybrid BARS process (Anshel, 1995; Dickson, 2000). For this reason, it was preferable to have the two individuals on the one panel to preserve the *overall* diversity of the two panels.

Secondly, the original intention was to include four academics, one from each of the four faculties, on the expert panels. However, time and workload constraints restricted the pool of academics who could be panel members. Four academics were identified who were both willing to be expert panel members and able to attend the expert panel workshops. Unfortunately, these academics were not representative of the four faculties. While it was desirable to have each of the four faculties represented on the expert panels, it was not considered essential. This was because those academic staff who were able to participate had considerable e-learning experience. In this instance, the depth of e-learning experience was considered as essential as the breadth of experience. As for the student panel members, staff selected for the two panel members were considered ‘expert’ according to the criteria presented by Anshel (1995).

The final composition of the two expert panels is presented in Figure 4.1.

Panel One	**Panel Two**
Student with e-learning experience	Student with e-learning experience
Lecturer (Social Science Education)	Lecturer (Higher Education)
Lecturer (Digital Literacies)	Lecturer (Adult Education)
Lecturer (ICT Education)	Lecturer (ICT Education)
Lecturer (Educational Contexts)	Lecturer (Linguistics)
Academic Developer	Academic Developer

Figure 4.1 – Expert panel composition

Finally, no payments or incentives were offered to panel members with the exception of one student who had travel costs reimbursed. With the selection and formation of the two expert panels finalised, Stage 1 of the Hybrid BARS process was complete. The convening of the two expert panel workshops is discussed next.

4.2 STAGE 2 – GENERATION OF COMPETENCIES

The two panel workshops convened to identify the e-learning performance dimensions and competencies were held three weeks apart in order to suit the work schedules of all participants (panel members and support personnel). Both panels followed the schedule of three distinct activities: developing performance dimensions, developing competencies and a final review, broken up into six sessions as indicated in Figure 3.3.

Two days before the running of the second expert panel workshop, the Academic Developer representative on the panel had to withdraw for personal reasons. Due to the lateness of this withdrawal, there was insufficient time to find a replacement and as a consequence, the second panel workshop was run with five expert panel members instead of six. Although previous implementations of the Hybrid BARS process had used six to ten participants in the expert panels (e.g., Anshel et al., 1987; Anshel & Webb, 1991; Moore et al, 1997), five participants in a panel was still considered to provide a sufficient range in panel diversity particularly as Panel One had previously gone ahead with the representation of an Academic Developer.

4.2.1 Session One

The objective of Session One was the development of performance dimensions for e-learning. Although there was an initial reluctance on behalf of both sets of panel members to begin the conversation, once started the challenge for the Panel Leader was to keep the discussion on track and on schedule. Rich conversation ensued as panel members discussed the performance dimensions for e-learning. As each performance dimension was agreed upon by panel members it was entered into the concept mapping software and projected on to a screen for all members to view. For both panel workshops, Session One went beyond the time allocated prompting the need for a change of schedule. By the close of Session One both panels had defined what they believed to be comprehensive sets of e-learning performance dimensions. Examples of performance dimensions generated during this session were: ‘knows how to construct knowledge’, ‘uses information skills’, and ‘ability to critique and evaluate resources’.

4.2.2 Session Two

Session Two began the process of generating sets of competencies for each of the performance dimensions developed in Session One. Although the procedure called for the generation of action words or phrases that would be later refined into competencies, both sets of panel members were able to construct competencies without requiring the intermediary step of developing preliminary action words or phrases. Panel members believed it was easier to develop a competency within its context rather than an isolated action word or phrase. For example, 'able to navigate large bodies of content', as opposed to simply, 'able to navigate'.

4.2.3 Session Three

The original purpose of Session Three was to develop competencies from the action words and phrases developed in Session Two. However, as this process had already begun in Session Two, Session Three continued with the process of developing competencies for each of the performance dimensions. One change however, was that panel members wished to work together during this session instead of separately as originally intended to develop the competencies. As the final outcome of the workshop was a consolidated list of competencies, there appeared to be no reason not to allow panel members to work together. Examples of competencies generated during this session were: 'able to evaluate information', 'values the contributions of others', and 'uses search engines'.

4.2.4 Session Four and Session Five

Sessions Four and Five continued the development of the competencies. The first expert panel completed Sessions Four and Five on time but the second expert panel made the decision to have a 'working lunch' as they continued developing the competencies.

4.2.5 Session Six

Session Six involved an item-by-item review of the performance dimensions and competencies developed by panel members. In this session, panel members were asked two questions:

1. Do the performance dimensions developed adequately represent all aspects of e-learning?

2. Do the competencies developed for each particular performance dimension reflect the full breadth of that dimension?

Both panels reached 100% consensus in the affirmative for each question. The workshop concluded with panel members being thanked for their contribution. The outcome of Stage 2 was the creation of two draft lists, one from each panel, of e-learning performance dimensions and competencies.

4.3 STAGE 3 – AMALGAMATION OF LISTS BY RESEARCHER

Stage Three involved the amalgamation of the two draft lists of e-learning performance dimensions and competencies into a single draft list. Amalgamation was undertaken by the Panel Leader. Lists were examined and changes were made in accordance to recommendations made by Cyrs et al. (1976, p. 5). These changes included: the combining of duplicate phrases, the clarification of unclear statements, removal of unnecessary statements, and items added to complete deficient statements. Care was undertaken to ensure that changes did not alter the original intent or meaning of the items. Examples of the type of changes made are presented in Figure 4.2.

Example	**Original Form**	**Modified Form**
Duplicate phrases	'Manages time appropriately' and 'Ability to manage time'	Works to a disciplined timeframe
Clarified statement	The student can determine the time available for a task, the time required for a task's sub tasks, a sequence in which to complete sub tasks, and can negotiate to have time to allocate to the task.	Plans a timeframe effectively
Unnecessary statement	Students who have just brought a computer should enrol at TAFE before the online course	Deleted due to not being a competency and irrelevant
Deficient statement	Interrogate information	Interrogate information to determine its utility

Figure 4.2 – Examples of changes during amalgamation of lists

Correction of spelling and punctuation and the conversion of statements to present tense were also made during this stage.

4.4 STAGE 4 – VERIFICATION OF AMALGAMATED LIST

The amalgamated draft list of performance dimensions and competencies (see Appendix 8) were sent to all panel members for verification and approval. Panel members were asked to review the list and provide feedback in relation to the following questions:

- Are there any performance dimensions you feel need to be added, combined or deleted?
- Do the competencies reflect accurately the performance dimension with which they are associated?
- Are there any competencies you feel are superfluous?
- Are there any competencies you feel are ambiguous?
- Are there any competencies you feel would need to be reworded for clarification purposes?

The changes made on the basis of feedback given by expert panel members are presented in Appendix 9. The new list based upon the suggested changes, underwent a final review by two expert panel members (one from each panel). Based upon the advice of the two panel members five competencies were reworded. These were:

- Competency 1.2 – *adapts learning style to the learning environment*, was clarified to *adapts learning style to the e-learning environment*. This was done to make the competency more focused on e-learning.
- Competency 1.3 – *adapts technology to match on learning style*, was considered problematic as there was concern about the degree technology could actually be adapted by students. The rephrased competency *uses technology to support own learning style* was considered to be more suitable.
- Competency 5.1 – *critiques responses of others in positive terms*, there was the view that the term 'constructively' would be a better indicator of effective critiquing. As a consequence, this competency was reworded to *critiques the responses of others constructively*.
- Competency 6.4 – *completes set tasks independently*, was changed *to undertakes set tasks independently*. It was considered that the word 'completes' would be better replaced by 'undertakes' as this was more of a process orientated term which better reflected the original intention for the item's inclusion.
- Competency 10.3 – *able to determine the accuracy of information through triangulation (i.e. several sources),* was clarified to *cross references between sources to determine accuracy*.

Finally, a few minor typographical errors were also identified during the final review and corrected. The final review and subsequent changes to the list of performance dimensions and competencies generated by the panel process concluded Stage 4 of the Hybrid BARS process and Phase One of the study. The outcome of Phase One was the construction of a Behaviourally Anchored Rating Scale for e-learning or BARS-EL.

4.5 DISCUSSION OF THE BARS-EL

The purpose of this section is to present and discuss the BARS-EL developed in Phase One of the study.

In total, 58 competencies classified into 16 performance dimensions were identified in Phase One of the Hybrid BARS process. Each of these competencies and their associated performance dimensions was considered by the two expert panels as being essential for e-learning (BARS-EL). The BARS-EL is presented below in Figure 4.3. Performance dimensions are presented in numbered bold type with their associated competencies following as indented points. The performance dimensions are arranged in alphabetical order and should not be considered as a hierarchy. As with previous implementations of the Hybrid BARS (e.g., Anshel, 1995; Anshel & Webb, 1991; Dickson, 2000), the associated competencies represent desirable behaviours of effective performance with all being considered of equal weighting.

A brief discussion on each of the performance dimensions and associated competencies is provided below.

1. Adopts an appropriate approach to learning

- 1.1 understands own cognitive processes and thinking strategies
- 1.2 adapts learning style to the e-learning environment
- 1.3 uses technology to support own learning style

This performance dimension and associated competencies focuses upon the strategies e-learners use for their own learning. The first competency, *understands own cognitive processes and thinking strategies*, highlights the importance of e-learners being able to monitor their own thinking or be *metacognitive* (McInerney & McInerney, 2006). Being metacognitive allows e-learners to adopt approaches and use strategies that best suit their favoured cognitive style.

The second and third competencies focus specifically upon learning style. The literature review highlighted the degree of uncertainty as to whether particular learning styles were more suited to e-learning environments than others. Implicit in the second competency, *adapts learning style to the e-learning environment*, is the idea that

1. Adopts an appropriate approach to learning

- 1.1 understands own cognitive processes and thinking strategies
- 1.2 adapts learning style to the e-learning environment
- 1.3 uses technology to support own learning style

2. Approaches and engages with tasks strategically

- 2.1 identifies the requirements necessary to complete a task
- 2.2 plans an appropriate strategy to undertake a task
- 2.3 uses problem solving strategies
- 2.4 engages in the process of reflection

3. Communicates effectively with members of the learning community

- 3.1 uses inter-personal communication skills
- 3.2 provides responses in clear, concise and unambiguous language
- 3.3 determines when it's time to 'listen' to or contribute a response
- 3.4 applies the rules of netiquette consistently

4. Creates opportunities for interaction

- 4.1 arranges schedule to allow for regular online sessions
- 4.2 seeks interaction with other members of the learning community
- 4.3 encourages others to post through positive responses

5. Critiques and evaluates effectively

- 5.1 critiques the responses of others constructively
- 5.2 evaluates a set of search results critically
- 5.3 critiques a web site in relation to content

6. Demonstrates self-direction as a learner

- 6.1 seeks information through either own enquiries or the questioning of others
- 6.2 goes outside the technology and learning community to seek information
- 6.3 identifies and rectifies gaps in one's own understanding
- 6.4 undertakes set tasks independently

7. Demonstrates time management skills

- 7.1 prioritises competing tasks within the time available
- 7.2 balances work, social, family and study commitments
- 7.3 anticipates and makes allowances for "wait time" in asynchronous discussions
- 7.4 works to a disciplined timeframe

8. Develops relationships within the learning community

- 8.1 shares personal experiences in responses when relating to topic and others
- 8.2 responds to others with respect
- 8.3 views oneself as a member of the learning community

Figure 4.3 – BARS -EL

(continued next page)

9. Displays confidence as a learner

- 9.1 views oneself positively as a learner
- 9.2 contributes new ideas to a discussion
- 9.3 justifies own stance on an issue
- 9.4 comments upon or critiques a response made by the lecturer

10. Employs a range of information skills

- 10.1 able to navigate large bodies of content
- 10.2 able to distinguish between relevant and irrelevant items
- 10.3 cross references between sources to determine accuracy

11. Knows how to construct knowledge

- 11.1 develops responses which synthesise a range of ideas
- 11.2 forms connections between prior knowledge and new knowledge
- 11.3 works with others to collaboratively construct knowledge
- 11.4 uses technology to assist in the construction of knowledge

12. Makes use of feedback

- 12.1 willing to have ideas challenged
- 12.2 considers and acts upon feedback from members of the learning community
- 12.3 uses feedback to evaluate own performance (self critique)

13. Uses relevant technology effectively

- 13.1 demonstrates knowledge and use of the Learning Management System
- 13.2 makes allowances for the virtual nature of the learning environment
- 13.3 selects the appropriate technology tool for the task at hand
- 13.4 integrates a variety of software applications to create a product
- 13.5 employs a logical process to identify and solve a computer problem

14. Uses teaching staff effectively

- 14.1 acknowledges the facilitation role of lecturer in the learning environment
- 14.2 recognises lecturer's response as a contribution and not the final word on an issue
- 14.3 asks for guidance or seeks clarification for misunderstandings

15. Uses the Internet effectively

- 15.1 uses a web browser with skill and purpose
- 15.2 uses search engines effectively
- 15.3 searches the Internet strategically
- 15.4 downloads and uploads information and resources

16. Works with information in a variety of formats

- 16.1 reads and writes at an appropriate level
- 16.2 accesses information from a variety of sources
- 16.3 extracts information from a variety of formats
- 16.4 presents information in a variety of formats (video, audio, etc)

Figure 4.3 – BARS -EL

(continued)

work effectively in e-learning environments. Previously, authors had highlighted the importance of e-learners being able to select the most appropriate cognitive strategies to suit their particular learning style (e.g., Birch, 2002). The third competency, *uses technology to support own learning style*, reflects the need for e-learners to be able to make similar decisions with regard to whatever technology they might require in any given situation.

2. Approaches and engages with tasks strategically

2.1 identifies the requirements necessary to complete a task

2.2 plans an appropriate strategy to undertake a task

2.3 uses problem solving strategies

2.4 engages in the process of reflection

This performance dimension relates to how effective e-learners approach and engage with tasks. It also reflects the greater degree of responsibility in planning and managing their own learning required by e-learners than learners in face-to-face environments. There is a degree of congruence between the four competencies under this dimension and the four stages of the problem solving strategy developed by Polya (1957). Polya's problem solving strategy can be considered as a heuristic (Panko, 1988) and hence can be generalised to different contexts. The similarity with the competencies suggests that e-learners who approach tasks from a problem solving perspective might have greater advantage over those who do not adopt such an approach.

3. Communicates effectively with members of the learning community

3.1 uses inter-personal communication skills

3.2 provides responses in clear, concise and unambiguous language

3.3 determines when it's time to 'listen' to or contribute a response

3.4 applies the rules of netiquette consistently

This performance dimension highlights the importance of communication in e-learning environments. All of the competencies under this dimension facilitate effective and efficient communication with other members of the learning community. The first competency, *uses inter-personal communication skills*, is a reflection of the importance of using communication as a means of building, enhancing, and maintaining interpersonal relationships. The second competency, *provides responses in clear, concise and unambiguous language*, identifies a communication skill shown to be critical in the development of online identity and social presence (Gunawardena, 1995; Hewson &

Hughes, 2005). The third competency*, determines when it's time to 'listen' to or contribute a response*, indicates that there is a strategic element involved in discerning the most appropriate time to either speak or listen. The final competency, *applies the rules of netiquette consistently*, acknowledges the informal rules that govern appropriate behaviour when communicating on the Internet. The willingness of e-learners to work within such boundaries is indicative of the understanding that the harmonious interaction with others is a critical factor contributing to overall effectiveness in an e-learning environment.

4. Creates opportunities for interaction

4.1 arranges schedule to allow for regular online sessions

4.2 seeks interaction with other members of the learning community

4.3 encourages others to post through positive responses

This performance dimension acknowledges the importance of interaction. The three competencies classified under this performance dimension are associated with e-learners being proactive in their interactions with others. The first competency, *arranges schedule to allow for regular online sessions* has to do with planning and providing time for being online to allow for opportunities for interaction with others to occur. The other two competencies focus upon opportunities for interaction but from two different perspectives. The competency, *seeks interaction with other members of the learning community*, sees e-learners active in seeking opportunities to interact with others while the competency*, encourages others to post through positive responses,* the focus is upon creating an environment in which other members of the e-learning community are willing to interact with them. This is a means of ensuring that opportunities for interaction will arise. Competencies in this performance dimension are critical in the development of an online identity (Hewson & Hughes, 2005).

5. Critiques and evaluates effectively

5.1 critiques the responses of others constructively

5.2 evaluates a set of search results critically

5.3 critiques a web site in relation to content

This performance dimension focuses upon one important dimension of information seeking behaviour, namely the ability to make judgments upon the quality, suitability and relevance of information obtained from different sources. Successful knowledge construction is dependent upon the suitability of the raw materials. In this respect, this performance dimension and its associated competencies deal with the evaluation of two major sources: other members of the learning community, and material from the Internet. With respect to the first competency, *critiques the responses of others constructively*, panel members were thinking in terms of responses from others within a Learning Management System such as emails, bulletin board postings and chat messages. The two other competencies deal with the evaluation of content on the Internet. These two competencies are related to each other, as the first of the two, *evaluates a set of search results critically*, reflects a process-orientated approach – with e-learners having to make judgements as to whether items located via search engines are worth further investigation – while the second competency, *critiques a web site in relation to content*, reflects a product-orientated approach involving the actual evaluation of content that has been located on the Internet. These three competencies were not specifically identified in the literature review.

6. Demonstrates self-direction as a learner

- 6.1 seeks information either through own enquiries or the questioning of others
- 6.2 goes outside the technology and learning community to seek information
- 6.3 identifies and rectifies gaps in one's own understanding
- 6.4 undertakes set tasks independently

The focus of this performance dimension is on self-direction which is a key principle of constructivism (McInerney & McInerney, 2006). All of the competencies within this performance dimension identify ways in which effective e-learners manage their own learning. The first competency, *seeks information either through own enquiries or the questioning of others*, considers effective e-learners as being active seekers of knowledge rather than passive recipients. The second competency, *goes outside the technology and learning community to seek information*, suggests that effective e-learners are willing to 'work outside of the square' to get whatever information they feel they need. The third competency, *identifies and rectifies gaps in one's own understanding*, indicates that e-learners need to be responsible for their own learning. This is achieved in two ways. Firstly, e-learners need to be able to identify gaps in their understanding through strategies such as self-monitoring; a process by which learners are able to keep track of their progress in understanding and remembering (Krause, Bochner, & Duchesne, 2006). Secondly, e-learners need to be able to seek out and locate the information they believe they need to complete their understanding. The fourth competency, *undertakes set tasks independently*, highlights the importance of e-learners being able to complete tasks without supervision, as is often the case in e-learning environments.

7. Demonstrates time management skills

7.1 prioritises competing tasks within the time available

7.2 balances work, social, family and study commitments

7.3 anticipates and makes allowances for “wait time” in asynchronous discussions

7.4 works to a disciplined timeframe

This performance dimension acknowledges the importance of time management, in particular the scheduling of tasks both on and offline. The first competency, *prioritises competing tasks within the time available*, highlights the importance of being able to schedule and prioritise tasks. There are many competing factors in the life of an e-learner and the ability to manage these is reflected in the second competency, *balances work, social, family and study commitments*. The third competency, *anticipates and makes allowances for “wait time” in asynchronous discussions*, reflects not only the asynchronous nature of many e-learning environments but more importantly highlights the need for e-learners to have the capacity to make allowances for this nature in their planning and scheduling. The fourth competency, *works to a disciplined timeframe*, indicates that the ability to plan and prioritise while important, is only one part of the equation. Effective e-learners need to be able to exercise self-discipline to ensure planned activities are completed in an efficient and timely manner.

8. Develops relationships within the learning community

8.1 shares personal experiences in responses when relating to topic and others

8.2 responds to others with respect

8.3 views oneself as a member of the learning community

This performance dimension focuses upon the importance of the learning community in e-learning environments. The first two competencies deal with interpersonal elements in respect to relationship building with other members of the learning community. In a social constructivist learning environment, knowledge is constructed through interaction with others. Therefore the ability to develop and maintain relations with other members of the learning community is a critical skill. In contrast, the third competency, *views oneself as a member of the learning community*, can be considered as an intrapersonal element as it is demonstrative of an understanding that effectiveness within an e-learning environment is contingent upon participation within the e-learning community.

9. Displays confidence as a learner

9.1 views oneself positively as a learner

9.2 contributes new ideas to a discussion

9.3 justifies own stance on an issue

9.4 comments upon or critiques a response made by the lecturer

This performance dimension acknowledges the importance of students being both confident within themselves and within the e-learning environment. The first competency, *views oneself positively as a learner*, highlights the importance of students being confident in their own skills and abilities as learners. Although beyond the scope of this thesis, Weiner's (1972) *attribution theory* and Bandura's (1986) *self-efficacy theory*, provide solid theoretical foundations supporting the validity of this competency. The three remaining competencies deal with interactions with other members of the e-learning community. Worthy of particular mention is the fourth competency, *comments upon or critiques a response made by the lecturer*. There was some discussion about this competency by expert panel members. There was general consensus on two points. Firstly, a willingness to critique responses made by lecturers was viewed positively by panel members. Secondly, it was agreed that critiques of lecturers by students were rare occurrences.

10. Employs a range of information skills

10.1 able to navigate large bodies of content

10.2 able to distinguish between relevant and irrelevant items

10.3 cross references between sources to determine accuracy

Competencies in this performance dimension are a reflection of the learning that occurs in e-learning environments being more than the transmission of knowledge but rather an active process in which e-learners need to be able to source and evaluate information independently. The first competency, *able to navigate large bodies of content*, is not only concerned with the large amounts of content available on the Internet, but also the large amounts of content generated within Learning Management Systems through tools such as bulletin boards, blogs and wikis. For the second competency, *able to distinguish between relevant and irrelevant items*, expert panel members believed that effective e-learners needed to be selective with regard to what items they directed their attention towards. As with the first competency, this includes both content found on the Internet and that generated within the Learning Management System. The third competency, *cross references between sources to determine accuracy*, is essentially about the validation of information. Effective e-learners need to be able to verify the accuracy of content sourced both from the Internet and the e-learning community.

11. Knows how to construct knowledge

11.1 develops responses which synthesise a range of ideas

11.2 forms connections between prior knowledge and new knowledge

11.3 works with others to collaboratively construct knowledge

11.4 uses technology to assist in the construction of knowledge

This performance dimension reflects the constructivist perspective that knowledge, rather than existing independently of the learner, is constructed by the learner (Vrasidas, 2000). The first competency, *develops responses which synthesise a range of ideas*, indicates the importance of the higher order thinking skill – *synthesis*, or the ability to bring together ideas to build new meaning and understandings. Panel members deliberately used the term 'responses' in order to be as non-prescriptive as possible. Thus a response could be an independent response to the lecturer, for example as a piece of assessment. It could also be a response to a bulletin board or chat room session amongst members of the e-learning community.

The inclusion of second competency, *forms connections between prior knowledge and new knowledge*, is supported by the work of Piaget, in particular *schema theory* and *adaptation.* Schema theory states that knowledge is organised into clusters of ideas or 'schemes' (Krause et al., 2006). The process by which connections are made between the new and existing knowledge in these schemes is known as *adaptation*. It is through these processes that knowledge is believed to be constructed (Krause et al., 2006).

The third competency, *works with others to collaboratively construct knowledge*, acknowledges that from a social constructivist perspective learning occurs through the interaction, discussion and the sharing of ideas with others (Yuen & Chow, 2000). The fourth competency, *uses technology to assist in the construction of knowledge*, highlights the importance of having sufficient technical skills to construct both new knowledge and knowledge artefacts. Such ability has been previously acknowledged by Brown's (2000) notion of e-learners as 'digital bricoleurs'.

12. Makes use of feedback

12.1 willing to have ideas challenged

12.2 considers and acts upon feedback from members of the learning community

12.3 uses feedback to evaluate own performance (self critique)

The competencies making up this performance dimension are concerned with the ability of e-learners to receive, respond, and act upon feedback. The literature review had previously highlighted that in e-learning environments feedback may not be readily available (Birch, 2002). Therefore, the ability to receive and respond to feedback when it does occur will be of critical importance. The first competency, *willing to have ideas challenged*, indicates that an important precursor to acting upon feedback is the willingness to be open to critique. The second competency, *considers and acts upon feedback from members of the learning community*, emphasises the importance of using feedback received from others to modify one's own performance. The third competency, *uses feedback to evaluate own performance (self critique)*, highlights the need for e-learners to be able to monitor and evaluate their own performance. This is critical because what characterises e-learning environments is the requirement for learners to take greater responsibility in the management of their own learning (Mayes & de Freitas, 2007; Stephenson, 2001). Consequently, being able to use feedback to make judgements about one's own progress would be an important part of this process.

13. Uses relevant technology effectively

13.1 demonstrates knowledge and use of Learning Management System

13.2 makes allowances for the virtual nature of the learning environment

13.3 selects the appropriate technology tool for the task at hand

13.4 integrates a variety of software applications to create a product

13.5 employs a logical process to identify and solve a computer problem

This performance dimension brings together a range of competencies associated with the technology used in e-learning environments. The first competency, *demonstrates knowledge and use of Learning Management System*, was also identified in the literature review as being an important competency (Dabbagh & Bannan-Ritland, 2005). This competency should be taken to include knowledge of the different types of tools (e.g., bulletin boards, chat, wikis) associated with Learning Management Systems as well.

The second competency, *makes allowances for the virtual nature of the learning environment*, was included as members of the expert panels believed that e-learners should be able to recognise and make adjustments for the differences between e- learning environments and face-to-face learning environments. There was consensus amongst panel members that it was important for students to understand that e-learning environments are often constructed to be metaphors of face-to-face environments; hence the use of terminology such as *chat rooms.* However, as all metaphors only approximate what they are representing, the expert panel members believed that e-learners should be able to recognise this for e-learning environments and make the appropriate allowances. This competency was not identified in the literature review.

The remaining three competencies focus on aspects of the use of technology. While the literature has previously identified the ability to use a variety of technology tools as a key skill (Carlson, Downs, Clark, & Repman, 1999; Clarke, 2004; Dabbagh & Bannan-Ritland, 2005; Kearsley, 2000; Pallof & Pratt, 2003), the competency, *selects the appropriate technology tool for the task at hand,* suggests that knowing *when* to use a particular technology tool is as important as knowing *how*. The competency, *integrates a variety of software applications to create a product*, echo Brown's (2000) sentiments that e-learners should be creators of knowledge as much as they are consumers. The final competency, *employs a logical process to identify and solve a computer problem*, is important because the ability to remove any barriers to access due to computer problems, while important in itself (Clarke, 2004), can shape both attitudes towards computers (Hiltz, 1994) and the motivation to be active online (Salmon, 2002).

14. Uses teaching staff effectively

14.1 acknowledges the facilitation role of lecturer in the learning environment

14.2 recognises lecturer's response as a contribution and not the final word on an issue

14.3 asks for guidance or seeks clarification for misunderstandings

This performance dimension is concerned with the ability of e-learners to make the best use of teaching staff. The first competency, *acknowledges the facilitation role of lecturer in the learning environment*, supports the idea that in e-learning environments teaching staff are not simply managers of learning but also useful resources that should be utilised. The second competency*, recognises lecturer's response as a contribution and not the final word on an issue*, expands upon the idea that teaching staff should be considered as resources and like any other resource, must not simply be taken at face value but rather should be critiqued and evaluated. Neither of these two competencies was identified in the literature review. The third competency, *asks for guidance or seeks clarification for misunderstandings*, indicates that effective e-learners are actively engaged in the learning process routinely seeking guidance and taking responsibility for their own learning.

15. Uses the Internet effectively

15.1 uses a web browser with skill and purpose

15.2 uses search engines effectively

15.3 searches the Internet strategically

15.4 downloads and uploads information and resources

The four competencies associated with this performance dimension consider the Internet to be more than a medium for the transmission of content, but rather a resource providing raw materials for the construction of knowledge. All of the competencies involve the interaction of e-learners with the Internet. The first competency, *uses a web browser with skill and purpose*, indicates that while it is important to be able to use a web browser with an appropriate degree of skill, there also needs to be an appropriate degree of intent. The second competency, *uses search engines effectively*, reflects the critical role played by search engines as the primary means of locating resources on the Internet. From the expert panel members' perspective, this competency was more than simply being able to access appropriate resources on the Internet but being able to do so in a timely and efficient manner. The third competency, *searches the Internet strategically*, while closely related to the second competency, views searching from a cognitive perspective and acknowledges the strategies employed by effective e-learners to navigate the Internet. The fourth competency, *downloads and uploads information and resources*, considers that effective e-learners are both consumers of content (as reflected in the term 'download') and producers and disseminators of content (reflected in the term 'uploads'). All four competencies were identified in the literature review. Their inclusion in the BARS-EL reinforces the critical role played by the Internet as a dissemination and storage medium for e-learning.

16. Works with information in a variety of formats

16.1 reads and writes at an appropriate level

16.2 accesses information from a variety of sources (e.g. web pages, podcasts)

16.3 extracts information from a variety of formats

16.4 presents information in a variety of formats (video, audio, etc)

This performance dimension takes into account the ability of digital information to exist in a variety of different formats. The first competency, *reads and writes at an appropriate level*, was considered critical because although content on the Internet can exist in a range of formats, currently much of it is in the written form (Kearsley, 2000). This is also the case for communication within Learning Management Systems through tools such as bulletin boards, email, chat rooms, blogs and wikis. Consequently, an appropriate level of reading and writing skills must be considered essential for e-learners to be able to express their ideas clearly and concisely with other members of the e-learning community. The remaining three competencies are reflection that digital information can exist in a variety of formats and effective e-learners must have the ability to be able to access, extract and present information in a range of these formats. Two of these competencies, *accesses information from a variety of sources (e.g. web pages, podcasts)* and *presents information in a variety of formats (video, audio, etc),* were identified in the literature review (Dabbagh & Bannan-Ritland, 2005), while the third competency, *extracts information from a variety of formats*, was not. However, implicit in Brown's (2000, p. 14) concept of the "digital bricoleur," who finds material on the Internet and then uses it to create others things, would be possession of the prerequisite ability to extract whatever was required from whatever format.

With discussion of the BARS-EL completed, the findings and implications of Phase One of the study are presented next.

4.6 FINDINGS AND IMPLICATIONS

Results and discussion in this chapter addressed the following two research questions:

Question 1.1 What performance dimensions and competencies, as identified by the Hybrid BARS process, are considered essential for e-learning?

Question 1.2 Are these e-learning competencies consistent with the e-learning competencies as identified in the literature?

In relation to Question 1.1, the BARS-EL constructed using the Hybrid BARS process, was comprised of 58 competencies all of which were considered as being essential for e-learning. These competencies were grouped in 16 performance dimensions. The performance dimensions reflected a diverse range of e-learning performance criteria.

With regard to the performance dimensions and competencies identified, three issues are worth exploring. Firstly, the number of performance dimensions and competencies in BARS-EL was comparable with the number identified in two previous studies in the field of Education. In the first study, Jessup and Webb (1994) identified 56 competencies categorised into 8 performance dimensions in the area of classroom management and discipline for primary and secondary teachers. In the second study, Moore and Webb (1995) identified 82 competencies across 16 performance dimensions for Personal Development, Health and Physical Education primary teachers. According to Dickson (2000), variations in the number of performance dimensions and competencies in Hybrid BARS should be expected. Therefore, on face value, the number of e-learning performance dimensions and competencies identified in the current study was 'roughly in the ballpark' when compared to studies of a similar type.

Secondly, when examined closely, the performance dimensions could be classified into four broad groups:

Intrapersonal – existing or occurring at the level of the individual:

1. Adopts an appropriate approach to learning
6. Demonstrates self-direction as a learner
9. Displays confidence as a learner

Interpersonal – existing or occurring at the level of the learning community:

3. Communicates effectively with members of the learning community
4. Creates opportunities for interaction
8. Develops relationships within the learning community

Strategies and Practices – dealing with the management of learning:

2. Approaches and engages with tasks strategically
5. Critiques and evaluates effectively
7. Demonstrates time management skills
10. Employs a range of information skills
11. Knows how to construct knowledge
12. Makes use of feedback
14. Uses teaching staff effectively
16. Works with information in a variety of formats

Technological – using tools to support learning:

13. Uses relevant technology effectively
15. Uses the Internet effectively

The number of performance dimensions falling into the 'Technological' category is worthy of discussion. As the focus of the study was on e-learning, it might have been expected that technology would be well represented throughout many of the performance dimensions. However, this was not supported by the data generated in Phase One of the study. Only two performance dimensions*: 13. Uses relevant technology* *effectively* (comprising 5 competencies) and *15. Uses the Internet effectively* (comprising 4 competencies), dealt specifically and exclusively with aspects of technology. Throughout the remaining performance dimensions, six individual competencies were identified that also specifically dealt with technology. These were:

1.3 uses technology to support own learning style
3.4 applies the rules of netiquette consistently
11.4 uses technology to assist in the construction of knowledge
16.2 accesses information from a variety of sources (e.g. web pages, podcasts)
16.3 extracts information from a variety of formats
16.4 presents information in a variety of formats (video, audio, etc)

Of the remaining competencies, eight were identified that were related to technology but only in terms of their context. In other words, they had been recontextualised for the e-learning environment. For example, for competency 1.2, *adapts learning style to the e-learning environment*, the only aspect of the competency relating to technology was its context – 'e-learning'. The seven other recontextualised competencies were:

4.1 arranges schedule to allow for regular online sessions
4.3 encourages others to post through positive responses
5.2 evaluates a set of search results critically
5.3 critiques a web site in relation to content
6.2 goes outside the technology and learning community to seek information
7.3 anticipates and makes allowances for "wait time" in asynchronous discussion
10.1 able to navigate large bodies of content

Therefore, apart from the two performance dimensions and a total of 22 competencies relating specifically to technology, all of the other performance dimensions and competencies encompassed practices that could be considered as being essential to learning in general, in particular, learning situated within the social constructivist paradigm. This conclusion lends support to the argument of Mayes (2001), who believed that new technologies such as the Internet did not require new theories of learning to explain them. Rather what was needed was the development of novel forms of process and organising structures for maintaining and enhancing the pedagogical principles fundamental to most forms of learning.

The alignment of the e-learning performance dimensions and competencies with social constructivism raises the third issue. It could be argued that because the request was made during the expert panel workshops for panel members to develop e-learning competencies within a social constructivist framework, the competencies identified were the simple consequence of this request. Critically, do the e-learning performance dimensions and competencies in the BARS-EL represent the full suite of performance dimensions and competencies for e-learning or simply those with a social constructivist 'flavour'? However, due to the nature of the Hybrid BARS process *any* competency that emerged from the expert panel deliberations and was subsequently endorsed by members of these panels would have been included in the BARS-EL. This was irrespective of whether or not it was aligned with social constructivism. The fact that all of the e-learning performance dimensions and competencies identified were aligned with the social constructivism, supports the decision to use social constructivism as the learning theory to underpin the e-learning competencies.

With regard to Question 1.2, the e-learning competencies identified were generally consistent with those identified in the literature review (see Sections 1.5.1 and Sections 1.5.2) with all competencies in the literature review being represented either directly or indirectly in the BARS-EL. However, six competencies were either new or significantly different from what had been identified previously. These were:

5.1 critiques the responses of others constructively
5.2 evaluates a set of search results critically
5.3 critiques a web site in relation to content
13.2 makes allowances for the virtual nature of the learning environment
14.1 acknowledges the facilitation role of lecturer in the learning environment
14.2 recognises lecturer's response as a contribution and not the final word on an issue

The first three competencies in this group belong to the performance dimension, *Critiques and evaluates effectively*. Self-evaluation had been identified as an important competency in the literature review but evaluating the responses of others, search results, or web sites had not been. However as discussed above, effective knowledge construction is dependent upon the ability to make proper judgments of the suitability of the raw materials, hence the inclusion of these three competencies in the BARS-EL.

The next competency, 13.2, reflects the notion that e-learners should be able to recognise and make adjustments for the differences between e-learning environments and face-to face learning environments. As discussed previously, panel members believed it was important for students to understand that e- learning environments are different to face-to-face learning environments. The final two competencies, 14.1 and 14.2, both belong to the performance dimension, *Uses teaching staff effectively*. This performance dimension focuses upon the facilitation role of teaching staff. Although facilitation by teaching staff has been identified previously as being important in the general e-learning literature (Salmon, 2000), these two competencies examine the facilitation role from an e-learner's perspective.

Overall, the BARS-EL was able to provide a profile of e-learners with a greater degree of detail than what appears to have been provided previously. Many of the competencies identified in the literature review tended to focus upon what students needed to *be* (i.e., traits and characteristics) rather than what they needed to *do*. What has been lacking are descriptions of e-learning competencies in behavioural specific terms.

In his study investigating soccer refereeing competencies, Dickson (2000) noted the value of adopting an integrated approach to competency development as this approach was able to provide a richer understanding of the performance requirements of the role being examined. This has proved to be the case for the current study with the integrated approach being able to capture and represent the e-learning competencies in multidimensional, behaviour specific terms. Consequently, all of the competencies in the BARS-EL can be observed, assessed, developed or refined. This makes the BARS-EL of great practical benefit.

4.7 CONCLUSION

The Hybrid BARS process was shown to be successful, leading to the identification of 58 e-learning competencies distributed across 16 performance dimensions. The performance dimensions identified could be classified into four broad groups: intrapersonal, interpersonal, strategies and practices, and technological. Only two of the 16 performance dimensions identified related exclusively to the use of technology. The remainder of the performance dimensions encompassed a broad range of practices, many of which could be considered as being essential for learning situated within a social constructivist paradigm in general.

With the conclusion of Phase One of the study, the construction of the BARS-EL was completed. In Phase Two of the study, the BARS-EL was externally validated and a survey of stakeholder perceptions of the relative levels of importance, difficulty and preparedness of the performance dimensions and competencies in the BARS-EL was conducted. From analysis of the data collected in Phase Two, further conclusions could be drawn about the e-learning performance dimensions and competencies. The data analysis also allowed conclusions to be made about e-learning in general, and the study site in particular. The next chapter presents the results from Phase Two of the study.

CHAPTER FIVE

PHASE TWO: VALIDATION OF THE BARS-EL AND STAKEHOLDER PERCEPTIONS RESULTS

This chapter presents the results for Phase Two of the study, and is divided into seven sections. The first section provides an overview of the external validation survey respondents. The second section presents the results for the confirmation of the performance dimension independence. In the third section, the results for the validation of the performance dimensions and e-learning competencies are given. The fourth section provides results for the assessment of the e-learning competencies with respect to their relative *importance*, *difficulty* and *preparedness*. In the fifth section, the results for the assessment of perspective differences are presented. The sixth section provides the results for the assessment of stakeholder differences. The seventh section provides a conclusion to the chapter.

5.1 EXTERNAL VALIDATION SURVEY RESPONDENTS

This section provides background information about the external validation survey and respondents. In particular, survey response rates, age and sex of the respondents, computing experience, and e-learning experience.

5.1.1 External validation survey response rates

Data were collected from 35 respondents, all of whom either studied or taught at the university in one or more units classified at *Option Three: Fully Online Delivery* (OL3). This represented a response rate of 39% of participants who indicated they would take part in the external validation survey. It was not possible to calculate response rates as a proportion of the total university sample as this data was not accessible to the researcher.

A breakdown of response rates by sub-group (i.e., sex and role) is presented in Table 5.1. The highest response rate was from female students (45%) and the lowest was from male staff (33%). Overall, females had a higher response rate than males.

Table 5.1 – Response rates by sub-group

Sample	Potential Sample (n)	Respondents (n)	Response Rate (%)
Female students	31	14	45
Male students	17	6	35
Female staff	24	9	38
Male staff	18	6	33
Totals	90	35	39

Respondents were drawn from all four faculties of the university and the Teaching and Learning Centre (TLC) administrative unit. The distribution of respondents by Faculty is provided in Table 5.2.

Table 5.2 – Response rates by Faculty

Faculty	Survey Respondents (n)	Survey Respondents (%)
Arts, Humanities and Social Sciences	8	23
Education, Health and Professional Studies	15	43
The Sciences	6	17
Economics Business and Law	2	6
Teaching and Learning Centre	4	11
Totals	35	100

5.1.2 Age and sex of respondents

The age and sex distributions of respondents by sub-group are provided in Table 5.3. Not surprisingly, students had a greater representation than staff in the younger age brackets, while the majority of staff represented were over 41 years of age. As all units identified at OL3 were postgraduate units, no students under 21 years of age were expected in the survey population.

Table 5.3 – Age by sex sub-group response rates

Age (years)	Students (n) (female)	Students (n) (male)	Staff (n) (female)	Staff (n) (male)	Totals (n)
Under 21	0	0	0	0	0
21 – 25	3	1	0	0	4
26 – 30	1	1	1	0	3
31 – 35	0	0	0	1	1
36 – 40	5	2	0	1	8
41 – 45	1	1	3	0	5
46 – 50	0	0	3	0	3
51 – 55	0	0	1	2	3
over 55	4	1	1	2	8
Totals	14	6	9	6	35

5.1.3 Computing experience

The respondents' self-rating of their computing experience is provided in Table 5.4. None of the respondents rated themselves as having 'No experience' which was to be expected as all respondents were participating in fully online units as either students or staff. To determine whether any statistically significant differences existed amongst stakeholders' level of computing experience, Z-tests for two proportions (LeBlanc, 2004) were conducted on the computing experience ratings between students and staff. No significant differences in computing experience were identified between the ratings of students and staff (see Appendix 10 for details).

Table 5.4 – Computing experience

Level	Students (n) (female)	Students (n) (male)	Staff (n) (female)	Staff (n) (male)	Totals (n)
No experience	0	0	0	0	0
Little experience	1	0	0	0	1
Some experience	3	0	2	2	7
Experienced	7	2	5	2	16
Very experienced	3	4	2	2	11
Totals	14	6	9	6	35

5.1.4 e-Learning experience

The respondents' self-rating of their e-learning experience is provided in Table 5.5. Z-tests for two proportions conducted on the e-learning experience ratings identified no significant differences in e-learning experience between students and staff (see Appendix 10).

Table 5.5 – e-Learning experience

Level	**Students (n) (female)**	**Students (n) (male)**	**Staff (n) (female)**	**Staff (n) (male)**	**Totals (n)**
No experience	0	0	0	0	0
Little experience	2	0	1	1	4
Some experience	4	2	3	1	10
Experienced	8	3	2	3	16
Very experienced	0	1	3	1	5
Totals	14	6	9	6	35

5.1.5 Summary

The number of respondents for the external validation of the BARS-EL was small (n = 35), however no assessment of what constitutes an adequate sample size for a Hybrid BARS study has been reported in the literature. Previous Hybrid BARS studies have shown wide variations in the numbers of participants used in the external validation stage; ranging from 16 to validate competencies for Sporting Development Officers (Webb et al., 1994), to 212 to validate competencies for basketball refereeing (Anshel, 1995). As the data in this study were to be analysed using a variety of statistical techniques, minimum sample sizes stipulated by the respective techniques were closely monitored. Additionally, reliability statistics generated by the statistical techniques were closely inspected to ensure they were within acceptable limits thereby reducing the possibility of results being confounded due to the relatively small sample size.

Respondents taking part in the external validation stage were drawn from across all four faculties of the university and represented all age groups except for the youngest age bracket. Thus, the sample was considered to be sufficiently representative of the e-learning stakeholders at the university.

No significant differences were identified between the self-rated levels of computing experience and e-learning experience of the student and staff respondents. This increased the likelihood that any differences identified between student and staff respondents' assessment of the e-learning performance dimensions and competencies would be the result of genuine differences between the two stakeholder groups rather than any differences in computing experience or e-learning experience.

The results and analysis of data collected from the external validation survey are presented in the five sections that follow.

5.2 CONFIRMATION OF PERFORMANCE DIMENSION INDEPENDENCE

One of the assumptions of Hybrid BARS is that the performance dimensions identified are conceptually distinct and independent. This means a particular cluster of competencies should be unique to the one performance dimension. To determine whether the performance dimensions in the BARS-EL were independent, factor analysis and Rasch analysis were used to assess the independence of the performance dimensions structure of the BARS-EL. If the independence of the performance dimension structure could be confirmed then subsequent analysis of the e-learning competencies would be undertaken within the performance dimension framework. If not, then the e-learning competencies would be analysed outside of this framework.

5.2.1 Confirmation using factor analysis

Factor analysis was applied to the *importance* data to determine the independence of the performance dimension structure by comparing the resulting factor solutions to the performance dimensions of the BARS-EL. For the independence of the performance dimensions to be confirmed, the performance dimensions and the e-learning competencies associated with them had to be comparable to the factor solution identified through factor analysis.

There was concern, however, that due to the small sample size (n = 35), the reliability of the factor analysis would be affected. Following the recommendation of MacCallum, Widaman, Zhang, and Hong (1999), that for small samples it was better to analyse small groups of variables with moderate numbers of factors, the 16 performance dimensions of the BARS-EL were randomly assigned to four equal sets. Factor analysis was applied to each of these four sets of performance dimensions and their associated competencies.

The four sets were:

Set One: performance dimensions 2, 6, 5, and 14;

Set Two: performance dimensions 1, 8, 13, and 15;

Set Three: performance dimensions 3, 7, 10, and 11;

Set Four: performance dimensions 4, 9, 12, and 16.

The disadvantage of not using the full data set was that it restricted the identification of all the variables (i.e., competencies) which had high loadings on to the factors identified. However, the identification of all of the variables for a particular factor was not the object of the exercise. The critical issue was whether the e-learning competencies for each of the performance dimensions were unique to that particular performance dimension. To confirm the independence of the performance dimensions for each of the sets analysed, four factors would need to be identified (analogous to the four performance dimensions making up each set) and the variables which loaded significantly on to each of these factors would have to be the e-learning competencies associated with that particular performance dimension.

All four sets of data were analysed using Principal Component Factor Analysis with oblique rotation using the oblim method (see Section 3.6.3). To determine the appropriateness of the sample for factor analysis, values for the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity (BTS) were calculated (see Table 5.6).

Table 5.6 – Values for KMO and BTS

Set	**KMO**	**BTS**	**Significance (*p*)**
1	0.556	181.002	.001
2	0.657	224.705	.001
3	0.536	223.305	.001
4	0.520	186.737	.001

As values for KMO were above the critical value of 0.5 and values for BTS were significant ($p < .05$), the data was considered to be suitable for factor analysis (see Section 3.6.3). However, it was noted that the values for KMO were just above the acceptable range (> 0.5).

The factors and their associated variables were identified using the four criteria:

1. Minimum eigenvalue of 1;
2. Minimum factor loading of 0.4 for each item;
3. Simplicity of the factor structure;
4. Exclusion of single factor items.

Set One Results

Applying the eigenvalue criterion of accepting values greater than one, six factors were extracted in 23 iterations. The associated statistics for these factors are presented in Table 5.7

Table 5.7 – Principal Component Factor Analysis for Set One

Factor	Eigenvalue	Variance (%)	Cumulative (%)
1	3.956	28.2	28.2
2	1.803	12.8	41.0
3	1.722	12.3	53.3
4	1.463	10.5	63.8
5	1.108	8.0	71.8
6	1.002	7.3	79.1

Inspection of Table 5.7 provided initial evidence that the performance dimension structure of the BARS-EL was not unique. Although there were four performance dimensions in the set, six factors were extracted. Inspection of the variables (i.e., competencies) that were loaded significantly onto the six factors allowed further assessment of performance dimension independence.

A factor loading of > 0.4 was considered to be an indication of a significant relationship between a variable and a factor. However, it was acknowledged that due to the sample size the reliability of the factor loading could be unduly affected. Although sample size does have an effect upon the reliability of factor loadings, several studies (e.g., Guadagnoli & Velicer, 1988; MacCallum et al., 1999) have shown this not to be as critical as once thought. In fact, it is possible to extract reliable factor solutions from samples that previously would have been considered too small for factor analysis. However, with small samples there is the increased likelihood of identifiable improper factor solutions (Guadagnoli & Velicer, 1988). Despite this, Guadagnoli and Velicer (1988) demonstrated that factors with four or more variables with factor loadings of greater than 0.6 were reliable regardless of the sample size. The resulting factor solutions (and loadings) for Set One are presented in Table 5.8.

Table 5.8 – Factor Solution for Set One

Factor 1		**Factor loading**
2.2	plans an appropriate strategy to undertake a task	0.875
6.1	seeks information through either own enquiries or the questioning of others	0.771
2.1	identifies the requirements necessary to complete a task	0.693
2.4	engages in the process of reflection	0.582
2.3	uses problem solving strategies	0.581
6.3	identifies and rectifies gaps in one's own understanding	0.444
Factor 2		**Factor loading**
5.1	critiques the responses of others constructively	0.884
5.2	evaluates a set of search results critically	0.681
Factor 3		**Factor loading**
14.3	asks for guidance or seek clarification for misunderstandings	- 0.946
14.1	acknowledges the facilitation role of lecturer in the learning environment	- 0.841
6.3	identifies and rectifies gaps in one's own understanding	- 0.596
14.2	recognises lecturer's response as a contribution and not the final word on an issue	- 0.475
Factor 4		**Factor loading**
5.3	critiques a web site in relation to content	0.862
5.2	evaluates a set of search results critically	0.616
Factor 5		**Factor loading**
6.2	goes outside the technology and learning community to seek information	0.906
Factor 6		**Factor loading**
6.4	undertakes set tasks independently	0.942

As the selection criteria (described above) stipulated that there would be no single item factors, Factor 5 and Factor 6 were excluded. Importantly, the competencies which significantly loaded on to these two factors were from the same performance dimension. This was further evidence that the performance dimensions of the BARS-EL were not independent.

Inspection of Table 5.8 provided two other pieces of evidence that the performance dimension structure was not unique. Firstly, although exclusion of Factor 5 and Factor 6 had left four factors remaining – which was the same number as the number of performance dimension in Set One – competencies from different performance dimensions had loaded significantly on to Factor 1 and Factor 2. Furthermore, four of the variables (i.e., competencies) in Factor 1 were either close to or above the threshold value of 0.6 demonstrated by Guadagnoli and Velicer (1988) to be indicative of a reliable factor structure. Consequently, there was a reasonable level of confidence that the factor structure could be trusted.

Secondly, two competencies, 5.2 and 6.3 were loaded significantly onto more than one factor. Competency 5.2 loaded significantly on to Factor 2 and Factor 4, while competency 6.3 loaded significantly on to Factor 1 and Factor 3. Although it is not uncommon for variables to load significantly on to more than one factor (Hair et al., 1998), it did draw the independence of the performance dimension structure further into question.

Despite the increasing evidence that the performance dimension structure was not unique, it was noted that in a number of cases the competencies making up a particular performance dimension were loaded significantly on to the same factor. For example, all of the competencies of Performance Dimension 2 were loaded on to Factor 1. However, while this suggests that in the case of Performance Dimension 2, competencies: 2.1, 2.2, 2.3, and 2.4, might be measuring a single underlying construct, the presence of two competencies from Performance Dimension 6 (i.e., 6.1 and 6.3) meant that this performance dimension was not completely independent of other performance dimensions in the BARS-EL.

Set Two, Set Three, and Set Four results

Factor analysis of Set Two, Set Three, and Set Four resulted in the extraction of five, five, and four factors respectively. As the purpose of the exercise was to assess the structure of the current performance dimensions rather than developing a new structure using factor analysis, specific discussion of the results of the factor analysis for Set Two, Set Three, and Set Four will not be given. The relevant statistics and factor solutions for these three sets are provided in Appendix 11. However, by means of a general discussion, factor solutions for these three sets were of a similar nature to Set One and were characterised by the following:

- competencies from different performance dimensions significantly loading on to the same factor;
- competencies being significantly loaded on to two factors;
- one factor with only one competency;

- all of the competencies associated with one performance dimension significantly loading onto a single factor.

The first three of these items were taken as further evidence that the performance dimension structure of the BARS-EL was not unique. With this and the other pieces of evidence, it was concluded that the independence of the performance dimensions could not be supported by factor analysis.

The following section provides the results of Rasch analysis which was used to confirm the findings of factor analysis.

5.2.2 Confirmation using Rasch analysis

As discussed in Section 3.6.3, the Rasch model is based upon the concept of unidimensionality. Consequently, items that are shown to fit the Rasch model may be considered as measuring a single underlying construct. If the e-learning competencies were shown to be unidimensional then their organisation within the performance dimensions would not be conceptually distinct and consequently the independence of the performance dimension structure could not be supported.

Rasch analysis was applied to the *importance* data and the relevant fit statistics were examined to determine the degree of fit of the data to the Rasch model (see Table 5.9).

Table 5.9 – Rasch fit statistics for Importance data

Criteria	**Statistic**	**Acceptable Values**
Item Summary		
Infit (mean squared)	1.00	0.6 to 1.4
Infit *t*	0.00	- 2 to +2
Outfit (mean squared)	1.06	0.6 to 1.4
Outfit *t*	0.20	- 2 to +2
Item reliability	0.72	> 0.7
Case Summary		
Infit (mean squared)	1.06	0.6 to 1.4
Infit *t*	0.00	- 2 to +2
Outfit (mean squared)	1.07	0.6 to 1.4
Outfit *t*	0.00	-2 to +2
Case reliability	0.93	>0.7

All fit statistics fell within acceptable limits suggesting that the data was in fact, unidimensional. In practical terms, this meant that all of the e-learning competencies were working together to measure a single underlying construct beyond the scope defined by the performance dimensions of the BARS-EL. This was taken as confirmation of the conclusion drawn from factor analysis that the performance dimension structure was not independent.

5.2.3 Summary

Despite the small sample size (n = 35) factor analysis was applied to four separate sets of performance dimensions and associated competencies. Measures of KMO and BTS indicated that the data was suitable to undergo factor analysis although the values for KMO were at the low end of the scale with regard to acceptability. Factor solutions for all four sets were generated and analysed. In several cases, competencies from different performance dimensions were significantly loaded on to the same factor. In order to be independent, performance dimensions should be conceptually distinct and competencies should only specify one performance dimension. As factor analysis demonstrated that this was not the case, the independence of the performance dimensions was brought into question. On four occasions, competencies were significantly loaded on to two factors, providing further evidence that the performance dimensions were not conceptually distinct. Rasch analysis indicated that the e-learning competencies were unidimensional and hence alternate groupings of the competencies other than those defined by the performance dimensions of the BARS-EL were possible.

As factor analysis and Rasch analysis were unable to confirm the independence of the performance dimensions, the decision was made in accordance with the Data Analysis Plan (see Section 3.6) to analyse the e-learning competencies outside of the performance dimension framework. This analysis begins below.

5.3 VALIDATION OF PERFORMANCE DIMENSIONS AND COMPETENCIES

The purpose of external validation was to determine whether the performance dimensions and competencies included in the BARS-EL had the support of stakeholders. External validation was undertaken using the *importance* data set.

5.3.1 Classification of performance dimensions and competencies

Respondents were asked to provide a rating on how important for effective e-learning the performance dimension or competency was perceived to be (see Appendix 12 for detailed cumulative frequency analysis results). Based upon these *importance* ratings, the e-learning performance dimensions and competencies were classified as: ‘Essential (must have)', 'Important (should have)', or 'Unimportant'. This rating was based upon the *importance* criteria previously provided in Figure 3.7.

5.3.2 Performance dimensions

Although the independence of the performance dimension structure could not be confirmed by factor analysis and Rasch analysis, *importance* ratings for the performance dimensions are reported as they provided a useful overview of stakeholders' views and an early indication that the e-learning competencies making up the BARS-EL were not all of equal importance.

Of the 16 performance dimensions identified by the Hybrid BARS process, nine were considered as 'Essential (must have)', six were considered as 'Important (should have)', and one was considered 'Unimportant' (see Table 5.10).

Table 5.10 – Classification of performance dimensions

Performance Dimensions Rated as Essential (must have)	
1.	Adopts an appropriate approach to learning
2.	Approaches and engages with tasks strategically
5.	Critiques and evaluates effectively
6.	Demonstrates self-direction as a learner
7.	Demonstrates time management skills
10.	Employs a range of information skills
11.	Knows how to construct knowledge
13.	Uses relevant technology effectively
15.	Uses the Internet effectively
Performance Dimensions Rated as Important (should have)	
3.	Communicates effectively with members of the learning community
4.	Creates opportunities for interaction
9.	Displays confidence as a learner
12.	Makes use of feedback
14.	Uses teaching staff effectively
16.	Works with information in a variety of formats
Performance Dimensions Rated as Unimportant	
8.	Develops relationships within the learning community

Inspection of the performance dimensions (PD) classified as 'Essential (must have)' suggested that they fell into three broad groups. Firstly, performance dimensions involved with the management of learning (e.g., PD, 1, 2, 6, and 7), secondly, performance dimensions involved with the interaction with content (e.g., PD, 5, 10, and 11), and thirdly, performance dimensions involved specifically with the interaction with technology (e.g., PD, 13 and 15).

Four of the six performance dimensions classified as 'Important (should have)' involved some form of interaction with members of the e-learning community (e.g., PD 3, 4, 12, and 14). Of the remaining two competencies, PD 9, could be considered as management of learning – although at a personal level, while PD 16, involved interaction with content The only performance dimension rated as 'Unimportant' was PD 8, *Develops relationships within the learning community*, involved interaction with members of the e-learning community.

In general, performance dimensions which dealt with aspects of the management of learning and interaction with content were rated as being more important than performance dimensions which focused on interactions within the e-learning community.

5.3.3 Competencies

To facilitate the analysis of the competencies independently of the performance dimension framework, competencies were grouped according to the categories used previously in the literature review (see Section 1.5.2). This was done as both a convenient means of organising the competencies and to help determine whether any patterns or trends could be identified in the ratings of the competencies. The groupings used were:

1. management of learning and the e-learning environment;
2. interaction with the learning content;
3. interaction with the e-learning community.

With regard to the *importance* ratings of individual competencies, of the 58 competencies identified by the Hybrid BARS process, 19 were considered as 'Essential (must have)' competencies, 29 were considered as 'Important (should have)' competencies, and 10 were considered 'Unimportant' (see Table 5.11). The competencies are numbered for identification purposes only and no hierarchy should be implied by their order. The number after each competency refers to the groupings (1, 2, or 3) described above.

Table 5.11 – Classification of competencies according to Importance

Competencies rated as Essential (must have)	
2.1	identifies the requirements necessary to complete a task (1)
2.2	plans an appropriate strategy to undertake a task (1)
3.2	provides responses in clear, concise and unambiguous language (3)
6.1	seeks information through either own enquiries or the questioning of others (3)
6.3	identifies and rectifies gaps in one's own understanding (2)
7.1	prioritises competing tasks within the time available (1)
7.2	balances work, social, family and study commitments (1)
8.2	responds to others with respect (3)
10.1	able to navigate large bodies of content (2)
10.2	able to distinguish between relevant and irrelevant items (2)
11.1	develops responses which synthesise a range of ideas (2)
11.2	forms connections between prior knowledge and new knowledge (2)
13.3	selects the appropriate technology tool for the task at hand (1)
14.3	asks for guidance or seek clarification for misunderstandings (3)
15.1	uses a web browser with skill and purpose (1)
15.2	uses search engines effectively (1)
15.3	searches the Internet strategically (1)
15.4	downloads and uploads information and resources (1)
16.1	reads and writes at an appropriate level (2)
Competencies rated as Important (should have)	
1.1	understands own cognitive processes and thinking strategies (1)
1.2	adapts learning style to the e-learning environment (1)
1.3	uses technology to support own learning style (1)
2.3	uses problem solving strategies (1)
2.4	engages in the process of reflection (1)
3.1	uses inter-personal communication skills (3)
3.3	determines when it's time to 'listen' to or contribute a response (3)
3.4	applies the rules of netiquette consistently (3)
5.1	critiques the responses of others constructively (3)
5.2	evaluates a set of search results critically (2)
5.3	critiques a web site in relation to content (2)
6.2	goes outside the technology and learning community to seek information (2)
6.4	undertakes set tasks independently (1)
7.3	anticipates and makes allowances for "wait time" in asynchronous discussions (1)
7.4	works to a disciplined timeframe (1)
9.1	views oneself positively as a learner (1)
9.3	justifies own stance on an issue (3)
10.3	cross references between sources to determine accuracy (2)
11.4	uses technology to assist in the construction of knowledge (1)
12.1	willing to have ideas challenged (3)
12.2	considers and acts upon feedback from members of the learning community (3)
12.3	uses feedback to evaluate own performance (self critique) (1)
13.1	demonstrates knowledge and use of the Learning Management System (1)
13.2	makes allowances for the virtual nature of the learning environment (1)
13.5	employs a logical process to identify and solve a computer problem (1)
14.1	acknowledges the facilitation role of lecturer in the learning environment (3)
14.2	recognises lecturer's response as a contribution and not the final word on an issue (3)
16.2	accesses information from a variety of sources (e.g. web pages, podcasts) (2)
16.3	extracts information from a variety of formats (2)
Competencies rated as Unimportant	
4.1	arranges schedule to allow for regular online sessions (3)
4.2	seeks interaction with other members of the learning community (3)
4.3	encourages others to post through positive responses (3)
8.1	shares personal experiences in responses when relating to topic and others (3)
8.3	views oneself as a member of the learning community (3)
9.2	contributes new ideas to a discussion (3)
9.4	comments upon or critiques a response made by the lecturer (3)
11.3	works with others to collaboratively construct knowledge (3)
13.4	integrates a variety of software applications to create a product (1)
16.4	presents information in a variety of formats (video, audio, etc) (2)

Competencies grouped in the *management of learning and the e-learning environment* and *interaction with the learning content* categories were well represented in the 'Essential (must have)' category making up 47% (n = 9) and 32% (n = 6) of the competencies respectively. Competencies classified as *interaction with the e-learning community* made up 21% (n = 4) of the total competencies classified as 'Essential (must have)'.

For the 29 competencies considered to be 'Important (should have), 48% (n = 14) of the competencies were grouped in the *management of learning and the e-learning environment* category, 21% (n = 6) were grouped in the *interaction with the learning content* category, and 31% (n = 9) were grouped in the *interaction with the e-learning community* category.

Of the 10 competencies considered as 'Unimportant', 80% (n = 8) were grouped in the *interaction with the e-learning community* category, while 10% (n = 1) were grouped in the *management of learning and the e-learning environment* category and 10% (n = 1) in the *interaction with the learning content* category.

5.3.4 Summary

External validation of the BARS-EL developed in Phase One indicated that out of the 58 competencies identified, 19 were considered as 'Essential (must have)' competencies, 29 were considered as 'Important (should have)', and 10 were considered 'Unimportant'. The classification of the competencies as 'Essential (must have)', 'Important (should have)', and 'Unimportant', provided initial evidence that the e-learning competencies making up the BARS-EL were not considered by stakeholders to be of equal importance. To confirm whether such was the case, further analysis was undertaken to determine the relative *importance* of the e-learning competencies. Similar analytical techniques were also applied to the *difficulty* and *preparedness* ratings to determine the relative *difficulty* and *preparedness* of the e-learning competencies. The results of this analysis are given next.

5.4 ASSESSMENT OF E-LEARNING COMPETENCIES

This section presents the results for the assessment of the e-learning competencies with respect to the *importance*, *difficulty* and *preparedness* perspectives. For each perspective, three types of analysis was undertaken: firstly, the classification of the e-learning competencies according to importance, difficulty and preparedness using frequency analysis; secondly, the ranking of the competencies using frequency analysis to determine if a discernable hierarchy was present in the *importance*, *difficulty* and *preparedness* ratings of the competencies; and thirdly, rankings of the competencies using Rasch analysis item estimates.

5.4.1 Classification of competencies according to Importance

Classification of the e-learning competencies with regard to importance was used previously to externally validate the e-learning competencies. Please refer to Section 5.3.3 for the results of this procedure.

5.4.2 Importance rankings using frequency analysis

Frequency counts for *importance* ratings were used to determine a ranking of relative *importance*. When ranked in order of importance based upon the 'Essential (must have)' criterion (see Figure 3.7), a discernable hierarchy was apparent (see Appendix 13). On this evidence, the competencies were ranked according to their Rasch item estimates.

5.4.3 Importance rankings using Rasch analysis

Rasch analysis was previously applied to the *importance* data set to assess the independence of the performance dimensions (see Section 5.2.2). The results of this analysis were also used to rank the e-learning competencies. The relevant fit statistics for the *importance* data set were presented previously in Table 5.9. To review, all fit statistics fell within acceptable limits indicating that the data was suitable for Rasch analysis. Table 5.12 provides a list of the e-learning competencies ranked according to each competency's Rasch item estimate.

Ranking the e-learning competencies according to their Rasch item estimates provided a good spread of rankings across the continuum and as the estimates were interval level, firm conclusions could be drawn about the relative *importance* of the respective competencies.

The competency ranked as most important was*: (7.2) balances work, social, family and study commitments*, followed by *(16.1) reads and writes at an appropriate level*, and *(7.1) prioritises competing tasks within the time available*. In terms of rankings, competencies with item estimates greater than two standard deviations from the mean are considered to be significant (Dickson, 2000). Consequently, competency 7.2 with a item estimate of 1.03 (SD = 0.50) could be considered as the most important e-learning competency with competency 16.1, with an item estimate of 0.91, ranked a close second.

Table 5.12 – Importance rankings of the competencies – Rasch analysis

Competency		Estimate	Rank
7.2	balances work, social, family and study commitments (1)	1.03	1
16.1	reads and writes at an appropriate level (2)	0.91	2
7.1	prioritises competing tasks within the time available (1)	0.89	3
2.2	plans an appropriate strategy to undertake a task (1)	0.85	4
13.3	selects the appropriate technology tool for the task at hand (1)	0.65	5
15.2	uses search engines effectively (1)	0.53	6
15.4	downloads and uploads information and resources (1)	0.49	7
15.1	uses a web browser with skill and purpose (1)	0.47	8
8.2	responds to others with respect (3)	0.41	9
6.4	undertakes set tasks independently (1)	0.4	10
3.2	provides responses in clear, concise and unambiguous language (3)	0.36	11
15.3	searches the Internet strategically (1)	0.33	12
2.1	identifies the requirements necessary to complete a task (1)	0.32	13
2.3	uses problem solving strategies (1)	0.31	14
10.3	cross references between sources to determine accuracy (2)	0.3	15
6.1	seeks information through either own enquiries or the questioning of others (3)	0.25	16
6.3	identifies and rectifies gaps in one's own understanding (2)	0.25	16
10.1	able to navigate large bodies of content (2)	0.25	16
11.2	forms connections between prior knowledge and new knowledge (2)	0.24	19
1.2	adapts learning style to the e-learning environment (1)	0.23	20
5.3	critiques a web site in relation to content (2)	0.22	21
14.1	acknowledges the facilitation role of lecturer in the learning environment (3)	0.21	22
5.2	evaluates a set of search results critically (2)	0.18	23
13.5	employs a logical process to identify and solve a computer problem (1)	0.15	24
3.1	uses inter-personal communication skills (3)	0.13	25
3.4	applies the rules of netiquette consistently (3)	0.1	26
12.3	uses feedback to evaluate own performance (self critique) (1)	0.1	26
14.2	recognises lecturer's response as a contribution and not the final word on an issue (3)	0.1	26
7.4	works to a disciplined timeframe (1)	0.09	29
11.4	uses technology to assist in the construction of knowledge (1)	0.08	30
5.1	critiques the responses of others constructively (3)	0.06	31
7.3	anticipates and makes allowances for "wait time" in asynchronous discussions (1)	0.05	32
14.3	asks for guidance or seek clarification for misunderstandings (3)	0.02	33
16.3	extracts information from a variety of formats (2)	0.01	34
4.1	arranges schedule to allow for regular online sessions (3)	-0.03	35
13.4	integrates a variety of software applications to create a product (1)	-0.09	36
2.4	engages in the process of reflection (1)	-0.11	37
4.2	seeks interaction with other members of the learning community (3)	-0.13	38
13.1	demonstrates knowledge and use of the Learning Management System (1)	-0.14	39
9.1	views oneself positively as a learner (1)	-0.16	40
4.3	encourages others to post through positive responses (3)	-0.17	41
13.2	makes allowances for the virtual nature of the learning environment (1)	-0.17	41
11.1	develops responses which synthesise a range of ideas (2)	-0.22	43
6.2	goes outside the technology and learning community to seek information (2)	-0.25	44
16.4	presents information in a variety of formats (video, audio, etc) (2)	-0.26	45
10.2	able to distinguish between relevant and irrelevant items (2)	-0.31	46
12.1	willing to have ideas challenged (3)	-0.31	46
1.1	understands own cognitive processes and thinking strategies (1)	-0.32	48
3.3	determines when it's time to 'listen' to or contribute a response (3)	-0.34	49
1.3	uses technology to support own learning style (1)	-0.44	50
9.2	contributes new ideas to a discussion (3)	-0.54	51
11.3	works with others to collaboratively construct knowledge (3)	-0.61	52
8.3	views oneself as a member of the learning community (3)	-0.72	53
8.1	shares personal experiences in responses when relating to topic and others (3)	-0.95	54
12.2	considers and acts upon feedback from members of the learning community (3)	-0.95	54
16.2	accesses information from a variety of sources (e.g. web pages, podcasts) (2)	-1.01	56
9.3	justifies own stance on an issue (3)	-1.1	57
9.4	comments upon or critiques a response made by the lecturer (3)	-1.61	58
	Mean	0.0	
	Standard Deviation	0.50	

Note: this table has been divided roughly into quarters simply to improve readability.

Inspection of Table 5.12 revealed a similar pattern to the classification of competencies (see Table 5.11) with competencies in the *management of learning and the e-learning environment* group and *interaction with the learning content* group, strongly represented in the top half of the Rasch estimate rankings. Significantly, eight of the ten most important competencies were from the *management of learning and the e-learning environment* group. The highest competency in the *interaction with the e-learning community* category was competency 8.2, *responds to others with respect*, which ranked equal 9th out of the 58 competencies.

The least important competency according to the Rasch item estimate rankings was: *(9.4) comments upon or critiques a response made by the lecturer*. Inspection of this competency's Rasch estimate showed it to be more than three standard deviations from the mean (-1.61, SD = 0.50) behind the next placed competency: *(9.3) justifies own stance on an issue*, just over two standard deviations from the mean (-1.1, SD = 0.50). With a differential of such magnitude, the relevance of competency 9.4 must be drawn into question.

5.4.4 Classification of competencies according to Difficulty

Respondents were asked to provide a rating on how difficult each e-learning competency was perceived to be (see Appendix 12). Based upon these ratings the e-learning competencies were classified as: 'Very Difficult', 'Difficult', or 'Easy'. This rating was based upon the *difficulty* criteria previously provided in Figure 3.8. The classification of the competencies with respect to these three criteria resulted in *all* 58 competencies being classified as 'Easy'.

5.4.5 Difficulty rankings using frequency analysis

Frequency counts for *difficulty* ratings of the e-learning competencies were used to determine a ranking of relative *difficulty*. When ranked in order of difficulty based upon the 'Very Difficult' criterion (see Figure 3.8), a discernable hierarchy was apparent. (see Appendix 14). Therefore, the decision was made to proceed with Rasch analysis

5.4.6 Difficulty rankings using Rasch analysis

Rasch analysis was applied to the *difficulty* data and the relevant fit statistics for the *difficulty* data set are presented in Table 5.13.

Table 5.13 – Rasch fit statistics for Difficulty data

Criteria	Statistic	Acceptable Values
Item Summary		
Infit (mean squared)	1.00	0.6 to 1.4
Infit *t*	0.00	- 2 to +2
Outfit (mean squared)	1.05	0.6 to 1.4
Outfit *t*	0.00	- 2 to +2
Item reliability	0.79	> 0.7
Case Summary		
Infit (mean squared)	0.99	0.6 to 1.4
Infit *t*	- 0.2	- 2 to +2
Outfit (mean squared)	1.00	0.6 to 1.4
Outfit *t*	- 0.2	-2 to +2
Case reliability	0.96	>0.7

All fit statistics fell within acceptable limits indicating that the data was unidimensional and suitable for Rasch analysis. Competencies were then ranked in order of their Rasch item estimate (analogous to the relative *difficulty* of the competencies). These rankings are presented in Table 5.14.

Ranking competencies according to their Rasch item estimates gave a good spread of rankings across the continuum and provided a clearer picture of the *difficulty* hierarchy.

The competency ranked as most difficult was *(10.1) able to navigate large bodies of content*, followed by *(10.2) able to distinguish between relevant and irrelevant items*, and *(7.4) works to a disciplined timeframe*. Competency 10.1 was the only competency with an item estimate greater than two standard deviations from the mean (0.99, SD = 0.46). The competency ranked as least difficult was *(8.2) responds to others with respect*. This competency's difficulty ranking was significant because it was the only competency at the lower end of the *difficulty* continuum with an item estimate greater than two standard deviations from the mean (- 0.94, SD = 0.46).

Inspection of the ten competencies ranked as most difficult showed that competencies in the *management of learning and the e-learning environment* and *interaction with the learning content* groups made up nine of the ten places. Only one competency in the *interaction with the e-learning community* group, *(9.3) justifies own stance on an issue,* was present, ranking equal fourth.

Table 5.14 – Difficulty rankings of the competencies – Rasch analysis

Competency		Estimate	Rank
10.1	able to navigate large bodies of content (2)	0.99	1
10.2	able to distinguish between relevant and irrelevant items (2)	0.91	2
7.4	works to a disciplined timeframe (1)	0.83	3
1.2	adapts learning style to the e-learning environment (1)	0.7	4
5.2	evaluates a set of search results critically (2)	0.7	4
9.3	justifies own stance on an issue (3)	0.7	4
2.1	identifies the requirements necessary to complete a task (1)	0.66	7
11.4	uses technology to assist in the construction of knowledge (1)	0.58	8
10.3	cross references between sources to determine accuracy (2)	0.5	9
7.1	prioritises competing tasks within the time available (1)	0.48	10
11.2	forms connections between prior knowledge and new knowledge (2)	0.47	11
7.2	balances work, social, family and study commitments (1)	0.44	12
9.4	comments upon or critiques a response made by the lecturer (3)	0.36	13
14.2	recognises lecturer's response as a contribution and not the final word on an issue (3)	0.36	13
5.3	critiques a web site in relation to content (2)	0.31	15
4.1	arranges schedule to allow for regular online sessions (3)	0.26	16
12.1	willing to have ideas challenged (3)	0.26	16
11.3	works with others to collaboratively construct knowledge (3)	0.2	18
6.2	goes outside the technology and learning community to seek information (2)	0.15	19
6.4	undertakes set tasks independently (1)	0.15	19
16.4	presents information in a variety of formats (video, audio, etc) (2)	0.15	19
2.3	uses problem solving strategies (1)	0.14	22
12.3	uses feedback to evaluate own performance (self critique) (1)	0.14	22
4.2	seeks interaction with other members of the learning community (3)	0.12	24
11.1	develops responses which synthesise a range of ideas (2)	0.12	24
1.3	uses technology to support own learning style (1)	0.09	26
9.1	views oneself positively as a learner (1)	0.06	27
3.2	provides responses in clear, concise and unambiguous language (3)	0.05	28
6.1	seeks information through either own enquiries or the questioning of others (3)	0.01	29
13.5	employs a logical process to identify and solve a computer problem (1)	0 .00	30
12.2	considers and acts upon feedback from members of the learning community (3)	-0.01	31
13.4	integrates a variety of software applications to create a product (1)	-0.04	32
6.3	identifies and rectifies gaps in one's own understanding (2)	-0.06	33
13.3	selects the appropriate technology tool for the task at hand (1)	-0.09	34
2.2	plans an appropriate strategy to undertake a task (1)	-0.14	35
13.1	demonstrates knowledge and use of the Learning Management System (1)	-0.18	36
3.3	determines when it's time to 'listen' to or contribute a response (3)	-0.21	37
14.1	acknowledges the facilitation role of lecturer in the learning environment (3)	-0.22	38
1.1	understands own cognitive processes and thinking strategies (1)	-0.25	39
16.2	accesses information from a variety of sources (e.g. web pages, podcasts) (2)	-0.25	39
8.1	shares personal experiences in responses when relating to topic and others (3)	-0.26	41
5.1	critiques the responses of others constructively (3)	-0.29	42
9.2	contributes new ideas to a discussion (3)	-0.35	43
15.3	searches the Internet strategically (1)	-0.35	43
16.3	extracts information from a variety of formats (2)	-0.35	43
13.2	makes allowances for the virtual nature of the learning environment (1)	-0.37	46
3.4	applies the rules of netiquette consistently (3)	-0.38	47
2.4	engages in the process of reflection (1)	-0.46	48
15.1	uses a web browser with skill and purpose (1)	-0.46	48
4.3	encourages others to post through positive responses (3)	-0.47	50
3.1	uses inter-personal communication skills (3)	-0.49	51
16.1	reads and writes at an appropriate level (2)	-0.57	52
15.2	uses search engines effectively (1)	-0.65	53
8.3	views oneself as a member of the learning community (3)	-0.67	54
14.3	asks for guidance or seek clarification for misunderstandings (3)	-0.67	54
15.4	downloads and uploads information and resources (1)	-0.83	56
7.3	anticipates and makes allowances for "wait time" in asynchronous discussions (1)	-0.9	57
8.2	responds to others with respect (3)	-0.94	58
	Mean	0.0	
	Standard Deviation	0.46	

Note: this table has been divided roughly into quarters simply to improve readability.

5.4.7 Classification of competencies according to Preparedness

Respondents were asked to provide a rating on the level of student *preparedness* for each e-learning competency (see Appendix 12). Based upon these ratings the e-learning competencies were classified as: 'Very Prepared', 'Prepared', or 'Poorly Prepared'. This rating was based upon the *preparedness* criteria previously provided in Figure 3.9. It should be noted however, that the *preparedness* data set was distinct from the *importance* and *difficulty* data sets because instead of asking respondents to rate the performance dimensions and competencies, individual student respondents were asked to rate themselves, and staff respondents were asked to rate the student body as a whole.

The classification of the e-learning competencies with respect to the *preparedness* ratings is presented in Table 5.15. The competencies are numbered for identification purposes only and no hierarchy should be implied by their order.

Examination of the *preparedness* ratings presented in Table 5.15, showed that there were *no* competencies for which students were considered to be 'Very Prepared', 23 competencies for which students were rated as being 'Prepared' and 35 competencies which students were rated as being 'Poorly Prepared'.

5.4.8 Preparedness rankings using frequency analysis

Frequency counts for *preparedness* ratings were used to determine a ranking of relative *preparedness*. When the e-learning competencies were ranked according to the 'Very Prepared' criterion (see Figure 3.9), a discernable hierarchy was apparent. (see Appendix 15). The decision was then made to proceed with Rasch analysis.

Table 5.15 – Classification of competencies according to Preparedness

Competencies rated as students being Very Prepared

No competencies were identified in this category

Competencies rated as students being Prepared

1.2	adapts learning style to the e-learning environment (1)
1.3	uses technology to support own learning style (1)
2.1	identifies the requirements necessary to complete a task (1)
2.3	uses problem solving strategies (1)
3.1	uses inter-personal communication skills (3)
3.3	determines when it's time to 'listen' to or contribute a response (3)
3.4	applies the rules of netiquette consistently (3)
4.3	encourages others to post through positive responses (3)
8.1	shares personal experiences in responses when relating to topic and others (3)
8.2	responds to others with respect (3)
8.3	views oneself as a member of the learning community (3)
9.1	views oneself positively as a learner (1)
9.2	contributes new ideas to a discussion (3)
9.3	justifies own stance on an issue (3)
11.2	forms connections between prior knowledge and new knowledge (2)
11.4	uses technology to assist in the construction of knowledge (1)
12.2	considers and acts upon feedback from members of the learning community (3)
12.3	uses feedback to evaluate own performance (self critique) (1)
13.3	selects the appropriate technology tool for the task at hand (1)
15.1	uses a web browser with skill and purpose (1)
15.2	uses search engines effectively (1)
15.4	downloads and uploads information and resources (1)
16.2	accesses information from a variety of sources (e.g. web pages, podcasts) (2)

Competencies rated as students being Poorly Prepared

1.1	understands own cognitive processes and thinking strategies (1)
2.2	plans an appropriate strategy to undertake a task (1)
2.4	engages in the process of reflection (1)
3.2	provides responses in clear, concise and unambiguous language (3)
4.1	arranges schedule to allow for regular online sessions (3)
4.2	seeks interaction with other members of the learning community (3)
5.1	critiques the responses of others constructively (3)
5.2	evaluates a set of search results critically (2)
5.3	critiques a web site in relation to content (2)
6.1	seeks information through either own enquiries or the questioning of others (3)
6.2	goes outside the technology and learning community to seek information (2)
6.3	identifies and rectifies gaps in one's own understanding (2)
6.4	undertakes set tasks independently (1)
7.1	prioritises competing tasks within the time available (1)
7.2	balances work, social, family and study commitments (1)
7.3	anticipates and makes allowances for "wait time" in asynchronous discussions (1)
7.4	works to a disciplined timeframe (1)
9.4	comments upon or critiques a response made by the lecturer (3)
10.1	able to navigate large bodies of content (2)
10.2	able to distinguish between relevant and irrelevant items (2)
10.3	cross references between sources to determine accuracy (2)
11.1	develops responses which synthesise a range of ideas (2)
11.3	works with others to collaboratively construct knowledge (3)
12.1	willing to have ideas challenged (3)
13.1	demonstrates knowledge and use of the Learning Management System (1)
13.2	makes allowances for the virtual nature of the learning environment (1)
13.4	integrates a variety of software applications to create a product (1)
13.5	employs a logical process to identify and solve a computer problem (1)
14.1	acknowledges the facilitation role of lecturer in the learning environment (3)
14.2	recognises lecturer's response as a contribution and not the final word on an issue (3)
14.3	asks for guidance or seek clarification for misunderstandings (3)
15.3	searches the Internet strategically (1)
16.1	reads and writes at an appropriate level (2)
16.3	extracts information from a variety of formats (2)
16.4	presents information in a variety of formats (video, audio, etc) (2)

5.4.9 Preparedness rankings using Rasch analysis

Rasch analysis was applied to the *preparedness* data and the relevant fit statistics for the *preparedness* data set are presented in Table 5.16.

Table 5.16 – Rasch fit statistics for Preparedness data

Criteria	**Statistic**	**Acceptable Values**
Item Summary		
Infit (mean squared)	1.01	0.6 to 1.4
Infit *t*	0.00	- 2 to +2
Outfit (mean squared)	1.03	0.6 to 1.4
Outfit *t*	0.10	- 2 to +2
Item reliability	0.74	> 0.7
Case Summary		
Infit (mean squared)	1.03	0.6 to 1.4
Infit *t*	- 0.3	- 2 to +2
Outfit (mean squared)	1.01	0.6 to 1.4
Outfit *t*	- 0.3	-2 to +2
Case reliability	0.97	>0.7

All fit statistics fell within acceptable limits indicating that the data was unidimensional and suitable for Rasch analysis. Competencies were ranked in order of Rasch item estimates (analogous to the relative *preparedness* of the competencies). These rankings are presented below in Table 5.17.

Ranking competencies according to their Rasch item estimates provided a good spread of rankings across the *preparedness* continuum.

The competency with the highest ranking in terms of student preparedness was, *(15.4) downloads and uploads information and resources*, followed by: (*8.2) responds to others with respect* – ranked 2nd, *(6.1) seeks information through either own enquiries or the questioning of others* – ranked 3rd, and (*3.4) applies the rules of netiquette consistently* – ranked 4th.

The lowest ranked competencies were: (*5.3) critiques a web site in relation to content* – ranked 56th, *(4.2) seeks interaction with other members of the learning community* – ranked 57th, and *(9.4) comments upon or critiques a response made by the lecturer* – ranked 58th. Competencies 4.2 and 9.4 were significant having item estimates greater than two standard deviations from the mean (- 1.07 and – 1.23 respectively, SD = 0.48).

Table 5.17 – Competencies by Preparedness rankings – Rasch analysis

Competency		Estimate	Rank
15.4	downloads and uploads information and resources (1)	0.95	1
8.2	responds to others with respect (3)	0.93	2
6.1	seeks information through either own enquiries or the questioning of others (3)	0.81	3
3.4	applies the rules of netiquette consistently (3)	0.76	4
15.2	uses search engines effectively (1)	0.7	5
15.1	uses a web browser with skill and purpose (1)	0.59	6
3.1	uses inter-personal communication skills (3)	0.54	7
12.2	considers and acts upon feedback from members of the learning community (3)	0.53	8
13.4	integrates a variety of software applications to create a product (1)	0.51	9
11.4	uses technology to assist in the construction of knowledge (1)	0.5	10
11.2	forms connections between prior knowledge and new knowledge (2)	0.43	11
7.4	works to a disciplined timeframe (1)	0.41	12
8.1	shares personal experiences in responses when relating to topic and others (3)	0.41	12
10.1	able to navigate large bodies of content (2)	0.39	14
1.2	adapts learning style to the e-learning environment (1)	0.32	15
11.3	works with others to collaboratively construct knowledge (3)	0.27	16
12.1	willing to have ideas challenged (3)	0.27	16
1.3	uses technology to support own learning style (1)	0.26	18
2.1	identifies the requirements necessary to complete a task (1)	0.25	19
16.4	presents information in a variety of formats (video, audio, etc) (2)	0.24	20
15.3	searches the Internet strategically (1)	0.17	21
14.1	acknowledges the facilitation role of lecturer in the learning environment (3)	0.14	22
7.3	anticipates and makes allowances for “wait time” in asynchronous discussions (1)	0.13	23
13.1	demonstrates knowledge and use of the Learning Management System (1)	0.13	23
9.2	contributes new ideas to a discussion (3)	0.1	25
3.2	provides responses in clear, concise and unambiguous language (3)	0.08	26
16.1	reads and writes at an appropriate level (2)	0.08	26
6.4	undertakes set tasks independently (1)	0.07	28
2.3	uses problem solving strategies (1)	0.05	29
8.3	views oneself as a member of the learning community (3)	0.04	30
7.1	prioritises competing tasks within the time available (1)	0.03	31
16.3	extracts information from a variety of formats (2)	-0.02	32
12.3	uses feedback to evaluate own performance (self critique) (1)	-0.03	33
10.3	cross references between sources to determine accuracy (2)	-0.08	34
14.3	asks for guidance or seek clarification for misunderstandings (3)	-0.08	34
13.3	selects the appropriate technology tool for the task at hand (1)	-0.11	36
16.2	accesses information from a variety of sources (e.g. web pages, podcasts) (2)	-0.11	36
10.2	able to distinguish between relevant and irrelevant items (2)	-0.14	38
4.3	encourages others to post through positive responses (3)	-0.15	39
9.3	justifies own stance on an issue (3)	-0.15	39
13.5	employs a logical process to identify and solve a computer problem (1)	-0.15	39
3.3	determines when it’s time to ‘listen’ to or contribute a response (3)	-0.19	42
2.2	plans an appropriate strategy to undertake a task (1)	-0.25	43
4.1	arranges schedule to allow for regular online sessions (3)	-0.25	43
9.1	views oneself positively as a learner (1)	-0.27	45
7.2	balances work, social, family and study commitments (1)	-0.41	46
13.2	makes allowances for the virtual nature of the learning environment (1)	-0.53	47
14.2	recognises lecturer's response as a contribution and not the final word on an issue (3)	-0.53	47
5.1	critiques the responses of others constructively (3)	-0.57	49
5.2	evaluates a set of search results critically (2)	-0.57	49
2.4	engages in the process of reflection (1)	-0.58	51
6.3	identifies and rectifies gaps in one's own understanding (2)	-0.58	51
11.1	develops responses which synthesise a range of ideas (2)	-0.6	53
1.1	understands own cognitive processes and thinking strategies (1)	-0.78	54
6.2	goes outside the technology and learning community to seek information (2)	-0.78	54
5.3	critiques a web site in relation to content (2)	-0.87	56
4.2	seeks interaction with other members of the learning community (3)	-1.07	57
9.4	comments upon or critiques a response made by the lecturer (3)	-1.23	58
	Mean	0.0	
	Standard Deviation	0.48	

Note: this table has been divided roughly into quarters simply to improve readability.

5.4.10 Summary

The identification of a hierarchy of competencies with respect to *importance*, *difficulty*, and *preparedness* perspectives confirmed that the e-learning competencies making up the BARS-EL were not of equal status. Ranking the e-learning competencies according to their Rasch analysis item estimates, provided a good spread of rankings across the continuum for all of the perspectives and as these rankings had an empirical basis, firm conclusions were able to be drawn about the relative *importance*, *difficulty* and *preparedness* of the e-learning competencies.

Preliminary inspection of the relative *importance*, *difficulty*, and *preparedness* rankings of the e-learning competencies suggested that differences existed between the three perspectives; for example, the presence of competencies ranked high in importance but low in preparedness. The results of the assessment of such perspective differences are presented next.

5.5 ASSESSMENT OF PERSPECTIVE DIFFERENCES

This section presents the results of the procedures used to determine if any statistically significant relationships could be identified between the relative *importance*, *difficulty* and *preparedness* of the e-learning competencies. Three combinations of perspectives were assessed:

- *importance – difficulty*;
- *importance – preparedness*;
- *difficulty – preparedness*.

5.5.1 Rasch analysis

All *importance*, *difficulty*, and *preparedness* data were aggregated and submitted to Rasch analysis for calibration on a single scale. In total, 174 items from the *importance*, *difficulty*, and *preparedness* data sets were analysed. Fit statistics are given in Table 5.18.

All fit statistics fell within acceptable limits indicating that the data was suitable for Rasch analysis. To facilitate subsequent analysis, the rescaled item estimates were re-sorted into the three perspectives (see Appendix 16 for re-sorted item estimates). As the item estimates were now interval level and normally distributed, they could be subjected to parametric analysis.

Table 5.18 – Rasch fit statistics for Importance/Difficulty/Preparedness data

Criteria	**Statistic**	**Acceptable Values**
Item Summary		
Infit (mean squared)	1.00	0.6 to 1.4
Infit *t*	0.10	- 2 to +2
Outfit (mean squared)	1.01	0.6 to 1.4
Outfit *t*	0.10	- 2 to +2
Item reliability	0.82	> 0.7
Case Summary		
Infit (mean squared)	1.02	0.6 to 1.4
Infit *t*	- 0.2	- 2 to +2
Outfit (mean squared)	1.01	0.6 to 1.4
Outfit *t*	- 0.3	-2 to +2
Case reliability	0.95	>0.7

Comparison of perspective means

To determine whether any statistically significant differences could be identified between the perspectives, means were calculated for each of the three perspectives (Table 5.19).

Table 5.19 – Item estimates means by perspective

Perspective	**Mean**	**SD**
Importance	0.428	0.442
Difficulty	- 0.372	0.349
Preparedness	- 0.055	0.313

Comparison of the means of the three perspectives suggested that differences existed between the perspectives. ANOVA techniques were used to determine whether these differences were statistically significant.

5.5.2 ANOVA

The rescaled Rasch item estimates were submitted to ANOVA. Prior to ANOVA, Levene's test was conducted on the item estimates for each of the three perspectives to determine whether variances in the groups were equal. A Levene statistic of 1.660 was calculated (p = .193), and as this was a non-significant result (p >.05), equal variances were assumed for the data sets.

A *F* ratio of 68.069 (df=172) was calculated indicating that a significant difference existed between the three perspectives ($p < .05$). This confirmed the differences previously suggested by the frequency analysis and Rasch analysis rankings. However, while the *F* ratio indicated that a significant difference existed between the perspectives, it was unable to identify the actual perspectives where the difference would be found. A Bonferroni test was conducted to identify those perspective-pairs that were the source of the significant difference (Table 5.20).

Table 5.20 – Bonferroni test results for significance.

Perspective-pair	**Mean Difference**	**Significance (*p*)**
Importance – Difficulty	.80470	.001
Importance – Preparedness	.48673	.001
Difficulty – Preparedness	- .31707	.001

The results from the Bonferroni test indicated that significant differences existed between *all* of the perspective-pairs. Cook's Distance was then used to identify the e-learning competencies responsible for the significant differences.

5.5.3 Cook's Distance

Item estimates derived for the ANOVA procedure were submitted for Cook's Distance analysis. For Cook's distance values > 1 are considered to be an indication of an item having a significant influence (Stevens, 2002). Inspection of values for Cook's Distance (see Appendix 17) indicated that none of the competencies were impacting significantly on any of the three perspective-pairs. The non-significant result suggested that no specific competencies were responsible for the significant difference between the perspectives. Rather, the significant difference between the perspectives could be attributed to an accumulative effect by all of the competencies (Dickson, 2000).

5.5.4 Rank-order comparisons

As parametric procedures were unable to identify the competencies responsible for the significant difference, rank-order comparisons between pairs of competencies across the perspectives of *importance*, *difficulty*, and *preparedness* were undertaken. Rank-order differentials were determined by taking the absolute value of the difference between each respective competency-pair.

A ranking differential of 31 places or greater was considered to be evidence of a competency-pair making a notable contribution to differences between perspective-pairs. The cut-off value of 31 was calculated as an equivalent ratio to Dickson's (2000) cut-off value of 20 or more places for 37 competencies. As the current study had identified 58 competencies, the cut-off value was calculated as: *58 x 20/37 = 31*.

Importance versus Difficulty

Rank-order differentials were calculated for the competency-pairs in the *importance* and *difficulty* perspectives (see Appendix 18). Applying the cut-off value of 31 or greater identified 11 competencies considered as having a notable effect with regard to the significant difference previously identified using ANOVA techniques (Table 5.21).

Table 5.21 – Competencies responsible for the significant difference between the Importance and Difficulty perspectives

Competency		**Differential**
9.3	justifies own stance on an issue	51
16.1	reads and writes at an appropriate level	50
8.2	responds to others with respect	48
15.2	uses search engines effectively	48
15.4	downloads and uploads information and resources	46
9.4	comments upon or critiques a response made by the lecturer	44
10.2	able to distinguish between relevant and irrelevant items	41
11.3	works with others to collaboratively construct knowledge	35
15.1	uses a web browser with skill and purpose	35
7.3	anticipates and makes allowances for 'wait time' in asynchronous discussions	33
2.2	plans an appropriate strategy to undertake a task	31

From a practical viewpoint, competencies ranked highly for importance and highly for difficulty would be of greater concern than competencies considered being of less importance or less difficulty. To identify such competencies, the competencies were placed in rank order of *importance*. The rankings for the ten most important competencies and their associated *difficulty* rankings and differentials are presented below in Table 5.22.

Table 5.22 – Rank-order differentials for the ten most important competencies with respect to Difficulty

Competency		**Importance Rank**	**Difficulty Rank**	**Differential**
7.2	balances work, social, family and study commitments	1	9	8
16.1	reads and writes at an appropriate level	2	52	50
7.1	prioritises competing tasks within the time available	3	11	8
2.2	plans an appropriate strategy to undertake a task	4	35	31
13.3	selects the appropriate technology tool for the task at hand	5	33	28
15.2	uses search engines effectively	6	54	48
2.1	identifies the requirements necessary to complete a task	7	5	2
3.2	provides responses in clear, concise and unambiguous language	7	27	20
8.2	responds to others with respect	9	57	48
15.1	uses a web browser with skill and purpose	10	45	35
15.4	downloads and uploads information and resources	10	56	46

Inspection of Table 5.22 indicated that competencies ranked high in importance were not necessarily ranked as the most difficult. The highest ranked competency for *importance*, *(7.2) balances work, social, family and study commitments*, ranked 9th in terms of its relative difficulty. Other competencies ranked high in *importance* generally ranked low in terms of their relative *difficulty*. The most notable exceptions were: *(2.1) identifies the requirements necessary to complete a task*, which ranked 7th for *importance* and 5th for *difficulty*, and *(7.1) prioritises competing tasks within the time available*, which ranked 3rd for *importance* and 11th for *difficulty*. Therefore, with regard to practical significance, competencies 7.2, 2.1, and 7.1, were the only competencies ranked highly in both importance and difficulty.

Further examination of Table 5.22 was unable to identify any distinct patterns with regard to the relationship between the relative *importance* of a competency and the relative *difficulty* of its execution. Essentially, simply because an e-learning competency had been recognised as important it did not necessarily follow that it was difficult.

Importance versus Preparedness

Rank-order differentials of the e-learning competencies for the *importance* and *preparedness* perspectives revealed discrepancies between the two perspectives (see Appendix 19). Applying the cut-off value of 31 or greater identified eight competencies believed to be influential in causing the significant difference between the *importance* and *preparedness* perspectives. The eight competencies and their respective ranking differentials are presented in Table 5.23.

Table 5.23 – Competencies responsible for the significant difference between Importance and Preparedness perspectives

Competency		**Differential**
8.1	shares personal experiences in responses when relating to topic and others	47
7.2	balances work, social, family and study commitments	45
12.2	considers and acts upon feedback from members of the learning community	45
2.2	plans an appropriate strategy to undertake a task	40
6.3	identifies and rectifies gaps in one's own understanding	35
1.3	uses technology to support own learning style	34
11.3	works with others to collaboratively construct knowledge	34
12.1	willing to have ideas challenged	31

However, while the size of the rank-order differentials shown in Table 5.23 was influential in causing the significant difference between the *importance* and *preparedness* perspectives, from a practical viewpoint, it would be useful to determine whether students were executing the most important competencies with the highest level of preparedness.

To identify those competencies considered of practical significance to the study, the rank-order differentials were adjusted in two ways. Firstly, as the direction of the rank-order differential was now relevant signed values were calculated; hence a competency ranked lower in *preparedness* than *importance* would be reported as a negative value, as:

rank-order differential = importance ranking – preparedness ranking

Secondly, the *importance* and *preparedness* perspectives were re-ordered according to their relative *importance* rankings. The rankings for the ten most important competencies are presented below in Table 5.24.

Organising the rankings in this manner allowed the competencies to be examined from a more practical viewpoint. Associated with the five most important competencies (i.e., 7.2, 16.1, 7.1, 2.2, and 13.3) were relatively low levels of student preparedness. The most important competency *(7.2) balances work, social, family and study commitments*, had the largest rank-order differential, emphasising its significance in terms of its overall *importance* and the relatively low level of *preparedness* of students for this e-learning competency. Competencies associated with the use of technology (i.e., 15.1 and 15.4), were ranked relatively highly in terms of preparedness.

Table 5.24 – Rank-order differentials for the ten most important competencies with respect to Preparedness

Competency		Importance Rank	Preparedness Rank	Differential
7.2	balances work, social, family and study commitments	1	46	-45
16.1	reads and writes at an appropriate level	2	31	-29
7.1	prioritises competing tasks within the time available	3	26	- 23
2.2	plans an appropriate strategy to undertake a task	4	44	-40
13.3	selects the appropriate technology tool for the task at hand	5	31	-26
15.2	uses search engines effectively	6	3	3
2.1	identifies the requirements necessary to complete a task	7	20	-13
3.2	provides responses in clear, concise and unambiguous language	7	28	-21
8.2	responds to others with respect	9	2	7
15.1	uses a web browser with skill and purpose	10	12	-2
15.4	downloads and uploads information and resources	10	1	9

Difficulty versus Preparedness

Rank-order differentials were calculated for the competency-pairs in the *difficulty* and *preparedness* perspectives (see Appendix 20). Applying the cut-off value of 31 or greater led to the identification of 18 competencies considered as having a notable effect upon the significant difference between the two perspectives. These competencies are presented in Table 5.25.

As for the previous two perspective-pairs, it was important to examine the ranking comparisons in terms of the practical significance of any differences between the *difficulty* and *preparedness* perspectives. From a practical viewpoint, it would be valuable to determine the level of preparedness of students for those competencies considered to be the most difficult. To achieve this the competencies were placed in rank order of *difficulty*. The rankings for the ten most difficult competencies and their associated *preparedness* rankings and differentials are presented below in Table 5.26.

Table 5.25 – Competencies responsible for the significant difference between Difficulty and Preparedness perspectives

Competency		**Differential**
8.2	responds to others with respect	55
15.4	downloads and uploads information and resources	55
15.2	uses search engines effectively	51
5.2	evaluates a set of search results critically	48
3.1	uses inter-personal communication skills	46
9.4	comments upon or critiques a response made by the lecturer	44
5.3	critiques a web site in relation to content	41
10.2	able to distinguish between relevant and irrelevant items	38
3.4	applies the rules of netiquette consistently	37
4.2	seeks interaction with other members of the learning community	37
7.2	balances work, social, family and study commitments	37
7.3	anticipates and makes allowances for 'wait time' in asynchronous discussions	37
6.2	goes outside the technology and learning community to seek information	36
14.2	recognises lecturer's response as a contribution and not the final word on an issue	35
15.1	uses a web browser with skill and purpose	33
9.3	justifies own stance on an issue	32
8.1	shares personal experiences in responses when relating to topic and others	31
11.1	develops responses which synthesise a range of ideas	31

Table 5.26 – Rank-order differentials for the ten most difficult competencies

Competency		**Difficulty Rank**	**Preparedness Rank**	**Differential**
10.1	able to navigate large bodies of content	1	14	13
7.4	works to a disciplined timeframe	2	13	11
10.2	able to distinguish between relevant and irrelevant items	3	41	38
5.2	evaluates a set of search results critically	4	52	48
2.1	identifies the requirements necessary to complete a task	5	20	15
9.3	justifies own stance on an issue	6	38	32
11.4	uses technology to assist in the construction of knowledge	7	8	1
1.2	adapts learning style to the e-learning environment	8	19	11
7.2	balances work, social, family and study commitments	9	46	37
11.2	forms connections between prior knowledge and new knowledge	10	9	1

When organised in this manner a trend emerged from Table 5.26 which suggested that competencies considered to be relatively more difficult were often associated with lower levels of student preparedness. For example, competency 10.2, *able to distinguish between relevant and irrelevant items* (ranked 3rd in *difficulty* and 41st in *preparedness*), and competency *5.2, evaluates a set of search results critically*, (ranked 4th in *difficulty* and 52nd in *preparedness*). However, Pearson's Correlation Coefficient identified no statistically significant correlation between the two perspectives (Pearson's r = - 0.188, p = .158).

The competency considered as being the most difficult, *(6.3) able to navigate large bodies of content,* ranked 14th in terms of preparedness. For the remaining competencies, the highest level of preparedness was for *(11.4) uses technology to assist in the construction of knowledge*, which ranked 8th in terms of preparedness and 7th in terms of difficulty.

Comparison of the Importance, Preparedness and Difficulty of the competencies

Previously, inspection of the rank-order differentials between the *importance* and *preparedness* perspectives indicated that the five most important competencies were associated with relatively low levels of student preparedness. The *difficulty* rankings for each of these five competencies were inspected to determine whether the low level of student preparedness for executing the most important competencies might be due to their difficulty. The five competencies and their relative *difficulty* rankings are presented in Table 5.27.

Table 5.27 – Difficulty ratings for the competencies ranked high in Importance but low in Preparedness

Competency		**Difficulty Ranking**
7.2	balances work, social, family and study commitments	9
7.1	prioritises competing tasks within the time available	11
13.3	selects the appropriate technology tool for the task at hand	33
2.2	plans an appropriate strategy to undertake a task	35
16.1	reads and writes at an appropriate level	52

Aside from competencies 7.1 and 7.2, those competencies ranked high in importance yet low in preparedness were not necessarily difficult. This suggests that any perceived lack of student preparedness for the most important e-learning competencies was not necessarily due to the relative difficulty of the competencies themselves.

5.5.5 Summary

Initial indications of disparities between perspectives identified when the e-learning competencies were ranked in terms of *importance*, *difficulty* and *preparedness* (see Section 5.4) were confirmed by ANOVA which identified statistically significant differences ($p < .05$) existing between the three perspective-pairs: *importance – difficulty, importance – preparedness*, and *difficulty – preparedness*. Subsequent analysis using Cook's Distance was unable to identify any one competency or sets of competencies responsible for the differences between the perspective-pairs. Thus, it was concluded that accumulative effects by all of the competencies were responsible for the significant differences identified. Rank-order comparisons applied to all three perspective-pairs identified sets of competencies, which due to the size of their rank-order differentials, were considered as having the most influence in causing the significant differences identified by ANOVA.

Rank-order comparisons for each of the three perspective-pairs were reviewed to identify competencies of practical significance to the study. For the *importance – difficulty* perspectives, rank-order comparisons showed that competencies ranked high in importance were not necessarily the most difficult to execute. For the *importance – preparedness* perspectives, rank-order comparisons indicated that the five most important competencies were associated with relatively low levels of student preparedness. Inspection of the *difficulty – preparedness* perspectives suggested that the more difficult competencies often ranked lower in terms of preparedness. However, Pearson's Correlation Coefficient calculated for this perspective-pair indicated that any correlation existing between the *difficulty – preparedness* perspectives was non-significant.

5.6 ASSESSMENT OF STAKEHOLDER DIFFERENCES

Differences in perceptions between e-learning stakeholders and expert panels with respect to the relative *importance* of the e-learning competencies were identified in Section 5.3 with competencies identified by the expert panels as essential for effective performance in an e-learning environment being classified as 'Essential (must have)', 'Important (should have)' or 'Unimportant' by the e-learning stakeholders (see Table 5.11). The purpose of this section is to report the results of the analysis undertaken to determine whether any differences in perceptions could also be identified between student and staff stakeholder groups with regard to the *importance*, *difficulty* and *preparedness* ratings of the e-learning competencies.

5.6.1 Inspection of group means

Group means for student and staff stakeholders were calculated using individual case estimates derived previously from Rasch analysis of *importance*, *difficulty* and *preparedness* ratings of the e-learning competencies (see Table 5.9, Table 5.13, and Table 5.16 for the relevant fit statistics for the *importance*, *difficulty* and *preparedness* perspectives). Comparison of the means suggested that differences existed between student and staff stakeholders, particularly for the *difficulty* and *preparedness* perspectives (see Table 5.28).

Table 5.28 – Case estimate means by group and perspective

Group	Importance	Difficulty	Preparedness
Students	- 0.900	0.329	- 1.435
Staff	- 0.826	- 0.302	0.555

MANOVA was used to determine whether any of these differences were statistically significant and hence worthy of further inspection.

5.6.2 MANOVA

MANOVA was applied to the Rasch case estimates (see Appendix 21) with each group representing independent variables and each of the three perspectives representing dependent variables. The homogeneity of the variance-covariance was assessed using Box's test yielding a value of 9.959 (p = .180). As this was a non-significant result (p > .05), the assumption of homogeneity of covariance matrices for MANOVA was met. A summary of the MANOVA test statistics are provided in Table 5.29

Table 5.29 – MANOVA test statistics

Test	Value	Exact F	Hypoth. DF	Error DF	Sig. (p)
Pillai's Trace	.383	6.402	3.000	31.00	.002
Wilk's Lamba	.617	6.402	3.000	31.00	.002
Hotellings Trace	.620	6.402	3.000	31.00	.002
Roys Largest Root	.620	6.402	3.000	31.00	.002

Although all four of the test statistics are considered equally effective in the detection of differences for small to moderate group sizes (Field, 2005), for completeness the four statistics were inspected. All of the multivariate test statistics identified a significant difference ($p < .05$) between stakeholder groups for one or more of the perspectives. However, these tests were unable to determine for which perspective(s) the significant difference was occurring. To identify the perspectives responsible for the significant difference univariate F-tests were conducted (see Table 5.30).

Table 5.30 – Univariate ANOVA test statistics

Perspective	**Mean Square**	**F ratio**	**Significance (*p*)**
Importance	0.046	0.068	.795
Difficulty	3.407	4.586	.040
Preparedness	24.981	16.991	.001

Results from the univariate ANOVA identified a significant difference ($p < .05$) between student and staff stakeholder groups for the *difficulty* and *preparedness* perspectives but not for the *importance* perspective ($p > .05$). Cook's Distance was applied to identify the competencies responsible for the significant difference between student and staff groups.

5.6.3 Cook's Distance

For the application of Cook's Distance, separate sets of Rasch item estimates for both student and staff stakeholder groups were generated using the *difficulty* and *preparedness* data sets. However, the item reliability indices for student and staff groups for both perspectives were below the acceptable limit of 0.7 (Table 5.31).

Table 5.31 – Rasch fit statistics for stakeholder groups

Criteria	**Students**	**Staff**	**Acceptable Values**
Item Summary – Difficulty			
Infit (mean squared)	1.00	1.00	0.6 to 1.4
Infit *t*	0.00	0.00	-2 to +2
Item reliability	0.68*	0.28*	> 0.7
Item Summary – Preparedness			
Infit (mean squared)	1.00	0.99	0.6 to 1.4
Infit *t*	0.00	0.00	-2 to +2
Item reliability	0.50*	0.50*	> 0.7

* indicates value below acceptable limit

Low item reliability values are generally due to low sample sizes (Linacre, n.d.). As samples for student (n=20) and staff (n=15) groups were small, this was the most likely explanation. Low item reliability can cause problems because sample sizes are too small to establish a reproducible item difficulty hierarchy (Linacre, n.d.). As the establishment of a reliable hierarchy of items was critical to the outcome of the study, the decision was made to continue the data analysis using non-parametric techniques.

5.6.4 Non-parametric analysis

With the reliability of the Rasch item estimates under question, analysis was undertaken using the raw Likert scale data. Cumulative percentages of the *importance*, *difficulty*, and *preparedness* ratings were calculated separately for student and staff stakeholder groups to determine the relative rankings of the e-learning competencies for the two groups across each of the three perspectives. As previously, competencies were ranked according the percentage of sample who responded in the 5 or 4 categories corresponding to the 'Essential' (Figure 3.7), 'Very Difficult' (Figure 3.8), and 'Very Prepared' (Figure 3.9) classifications. Each perspective therefore had two sets of ranks – one for students and one for staff (see Appendices 22, 23, and 24 for the complete sets of rankings).

Mann-Whitney test

Previously, univariate ANOVA (see Table 5.30) had identified a significant difference between stakeholder groups for both the *difficulty* and *preparedness* perspectives and no significant difference between stakeholder groups for the *importance* perspective. These calculations had been based upon Rasch case estimates which, although had been shown to be reliable (see Table 5.9, Table 5.13, and Table 5.16), for consistency and thoroughness, significant differences were re-tested using the non-parametric Mann-Whitney test. This test, which is used to determine whether significant difference exist between two groups (Field, 2005), was applied to student and staff cumulative percentages for each of the three perspectives (see Table 5.32).

Table 5.32 – Mann-Whitney test statistics

Perspective	**U Statistic**	**Z Statistic**	**Significance (p)**
Importance	1623.000	- .327	.744
Difficulty	1247.500	- 2.404	.016
Preparedness	88.000	- 8.814	.001

The Mann-Whitney test identified a non-significant result between stakeholder groups for the *importance* perspective ($p > .05$) and a significant result between stakeholder groups for both the *difficulty* and *preparedness* perspectives ($p < .05$). Thus, results from the Mann-Whitney test confirmed the results previously obtained using univariate ANOVA (see Table 5.30).

With no significant difference identified between student and staff perceptions by either the Mann-Whitney test or ANOVA with respect to relative *importance* of the e-learning competencies, no further analysis of the *importance* perspective was undertaken. For the *difficulty* and *preparedness* perspectives, rank-order comparisons were used to identify the competencies likely to be responsible for the significant difference identified between student and staff groups for both of these perspectives.

5.6.5 Rank-order comparisons

In order to identify the competencies believed to be causing the significant difference identified between the groups, cumulative percentages for student and staff groups were ranked for both the *difficulty* and *preparedness* perspectives (see Appendices 25 and 26). A rank-order differential was determined by calculating the difference in ranking each competency pair of student and staff groups.

Difficulty perspective

As for the assessment of the perspective differences (see Section 5.5), a rank-order differential of 31 places or greater was considered to be influential in causing the significant difference between student and staff groups. Three competencies were identified with a cut-off value of 31 or more places (see Table 5.33).

Table 5.33 – Competencies considered influential in the significant difference between student and staff stakeholder groups for the Difficulty perspective

Competency		**Student Ranking**	**Staff Ranking**	**Differential**
4.3	encourages others to post through positive responses	13	50	37
12.3	uses feedback to evaluate own performance (self critique)	40	3	37
11.3	works with others to collaboratively construct knowledge	1	32	31

A notable inclusion in these three competencies, was the competency ranked by students as being the most difficult, *(11.3) works with others to collaboratively construct knowledge*. However, it was noted that previously all of the competencies had been classified as 'Easy' (see Section 5.4.4), so competency 11.3 would be best described as the competency ranked the *least easiest* by students to avoid overemphasising its actual level of difficulty.

To examine differences between students and staff from a more practical perspective, the competencies were ranked according to the *difficulty* ratings of students. Table 5.34 presents the ten highest ranked competencies for *difficulty* according to students and the corresponding rankings of these competencies made by staff. Signed values are reported with a negative differential being an indication of students ranking a competency as being more difficult than did staff.

Table 5.34 – Comparison of the ten most difficult competencies according to students

Competency		**Student Ranking**	**Staff Ranking**	**Differential**
7.4	works to a disciplined timeframe	1	3	-2
11.3	works with others to collaboratively construct knowledge	1	32	-31
7.1	prioritises competing tasks within the time available	3	14	-11
7.2	balances work, social, family and study commitments	3	9	-6
11.1	develops responses which synthesise a range of ideas	3	9	-6
1.2	adapts learning style to the e-Learning environment	6	13	-7
10.1	able to navigate large bodies of content	6	1	5
10.2	able to distinguish between relevant and irrelevant items	6	3	3
4.1	arranges schedule to allow for regular online sessions	9	24	-15
4.2	seeks interaction with other members of the learning community	9	32	-23
10.3	cross references between sources to determine accuracy	9	9	0

As this table was constructed from frequency analysis of the raw Likert scores, multiple rankings of items – common when data of this type is ranked – were evident in the results. Despite this, differences between the ranking of the e-learning competencies between students and staff were apparent. Eight of the eleven competencies listed in Table 5.34, were ranked by students as being more difficult than by staff. Again, it should be noted that all of the competencies had been classified as

'Easy'. However, the fact that differences existed in student and staff perceptions of the difficulty of the e-learning competencies are possibly more important than the nature of the differences themselves.

Preparedness perspective

The rank-order differentials between student and staff groups were calculated for the *preparedness* perspective and ten competencies were identified with a cut-off value of 31 or more places (Table 5.35).

Table 5.35 – Competencies considered influential in the significant difference between student and staff stakeholder groups for the Preparedness perspective

Competency		**Student Ranking**	**Staff Ranking**	**Differential**
2.1	identifies the requirements necessary to complete a task	6	44	38
7.2	balances work, social, family and study commitments	55	17	38
16.4	presents information in a variety of formats (video, audio, etc)	55	17	38
3.3	determines when it's time to 'listen' to or contribute a response	10	47	37
11.1	develops responses which synthesise a range of ideas	10	47	37
2.2	plans an appropriate strategy to undertake a task	19	53	34
3.2	provides responses in clear, concise and unambiguous language	10	44	34
5.2	evaluates a set of search results critically	19	53	34
8.1	shares personal experiences in responses (e.g. via email, bulletin boards, chat) when relating to topic and others	42	10	32
16.1	reads and writes at an appropriate level	2	33	31

Examination of Table 5.35 showed that students had higher *preparedness* rankings than staff for seven out of the ten competencies. One competency ranked by staff at a higher level of preparedness than by students was *(7.2) balances work, social, family and study commitments*. This competency was significant as it was one of three competencies with the largest ranking differential (38 places) plus it was the competency previously ranked as the most important (see Table 5.12). Also included in the list of competencies with large rank-order differentials were the second (16.1) and fourth (2.2) most important competencies (see Table 5.12). Students ranked these two competencies high for preparedness while staff ranked student preparedness as low.

The *preparedness* rankings for the e-learning competencies were reorganised in three ways to allow the differences between students and staff to be examined from a more practical perspective. Firstly, the competencies were ranked according to the *preparedness* ratings of students. Table 5.36 presents the ten highest ranked competencies for *preparedness* according to students and the corresponding rankings of these competencies made by staff. In this instance, a negative differential is an indication of students ranking a competency with a higher level of preparedness than did staff.

Table 5.36 – Comparison of the ten most prepared competencies according to students

Competency		**Student Ranking**	**Staff Ranking**	**Differential**
11.2	forms connections between prior knowledge and new knowledge	1	17	-16
8.2	responds to others with respect	2	3	-1
15.1	uses a web browser with skill and purpose	2	2	0
15.4	downloads and uploads information and resources	2	6	-4
16.1	reads and writes at an appropriate level	2	33	-31
2.1	identifies the requirements necessary to complete a task	6	44	-38
3.4	applies the rules of netiquette consistently	6	28	-22
9.1	views oneself positively as a learner	6	13	-7
15.2	uses search engines effectively	6	7	-1
2.3	uses problem solving strategies	10	28	-18
3.1	uses inter-personal communication skills	10	28	-18
3.2	provides responses in clear, concise and unambiguous language	10	44	-34
3.3	determines when it's time to 'listen' to or contribute a response	10	47	-37
6.1	seeks information through either own enquiries or the questioning of others	10	3	7
9.2	contributes new ideas to a discussion	10	34	-24
11.1	develops responses which synthesise a range of ideas	10	47	-37
13.1	demonstrates knowledge and use of Learning Management System	10	1	9
15.3	searches the Internet strategically	10	12	-2

Students gave a higher preparedness ranking than did staff for 15 of the 18 competencies identified. Of the five competencies with the most marked discrepancies (i.e., > 31 places) between the perceptions of student and staff, four could be considered as being fundamental for university-level studies in general. These were: *(16.1) reads and writes at an appropriate level*, *(2.1) identifies the requirements necessary to complete a task*, *(3.2) provides responses in clear, concise and unambiguous language*, and *(11.1) develops responses which synthesise a range of ideas*. For all four of these competencies, student rankings of *preparedness* were higher than staff rankings. The other competency with a large discrepancy between student and staff rankings was *(3.3) determines when it's time to 'listen' to or contribute a response*. For this competency, the student *preparedness* ranking was also higher than the staff ranking.

Staff gave higher preparedness rankings than students for two of the remaining three competencies identified in Table 5.36. However, none of the rank-order differentials had such marked differences as identified for the competencies described above. The remaining competency 15.1, *uses a web browser with skill and purpose*, was given the same rank by both students and staff (2nd). However, to state that students and staff held the same opinion with regard to the level of preparedness for this competency would be misleading as the data was derived from frequency analysis and such a conclusion could not be made with any degree of empirical certainty.

Secondly, the competencies for which students considered themselves as being the least prepared were inspected. Table 5.37 presents the ten lowest ranked competencies for *preparedness* according to students and the corresponding rankings of these competencies made by staff. In this instance, a positive differential is an indication of students ranking a competency with a lower level of preparedness than did staff.

Students gave lower *preparedness* rankings than did staff for 9 of the 11 competencies identified. The two competencies with the most marked discrepancies (i.e., > 31 places) were: *(7.2) balances work, social, family and study commitments,* and *(16.4) presents information in a variety of formats (video, audio, etc)*. For both of these competencies student ratings of *preparedness* were lower than staff ratings. The two competencies staff considered students to be less prepared than what students considered were *(9.4) comments upon or critiques a response made by the lecturer*, and *(12.1) willing to have ideas challenged*. The rank-order differentials for both of these competencies were not relatively large to (i.e., 10 or less places), so students and staff could be considered to be holding similar perceptions of these two competencies – one dealing with giving critique (9.4), and the other with receiving critique (12.1).

Table 5.37 – Comparison of the ten least prepared competencies according to students

Competency		Student Ranking	Staff Ranking	Differential
1.1	understands own cognitive processes and thinking strategies	57	53	4
4.1	arranges schedule to allow for regular online sessions	57	47	10
7.2	balances work, social, family and study commitments	55	17	38
16.4	presents information in a variety of formats (video, audio, etc)	55	17	38
2.4	engages in the process of reflection	53	28	25
4.2	seeks interaction with other members of the learning community	53	47	6
1.2	adapts learning style to the e-learning environment	48	28	20
4.3	encourages others to post through positive responses	48	39	9
9.4	comments upon or critiques a response made by the lecturer	48	57	-9
10.3	cross references between sources to determine accuracy	48	40	8
12.1	willing to have ideas challenged	48	58	-10

Thirdly, the *preparedness* rankings were reorganised to identify the competencies for which staff considered students to be the least prepared. Table 5.38 presents the ten lowest ranked competencies for *preparedness* according to staff and the corresponding rankings of these competencies made by students. In this instance, a positive differential is an indication of staff ranking a competency with a lower level of preparedness than did students.

Staff gave lower *preparedness* rankings than did students for 9 of the 12 competencies identified. Four competencies were identified with marked differences (i.e., > 31 places) between staff and students: *(2.2) plans an appropriate strategy to undertake a task*, *(5.2) evaluates a set of search results critically*, *(3.3) determines when it's time to 'listen' to or contribute a response*, and *(11.1) develops responses which synthesise a range of ideas*. These competencies, as with a number of other competencies in the list, were associated with activities such as planning, critiquing, evaluating and decision making.

Table 5.38 – Comparison of the ten least prepared competencies according to staff

Competency		Staff Ranking	Student Ranking	Differential
12.1	willing to have ideas challenged	58	48	-10
9.4	comments upon or critiques a response made by the lecturer	57	48	-9
1.1	understands own cognitive processes and thinking strategies	53	57	4
2.2	plans an appropriate strategy to undertake a task	53	19	-34
5.1	critiques the responses of others constructively	53	27	-26
5.2	evaluates a set of search results critically	53	19	-34
3.3	determines when it's time to 'listen' to or contribute a response	47	10	-37
4.1	arranges schedule to allow for regular online sessions	47	57	10
4.2	seeks interaction with other members of the learning community	47	53	6
6.3	identifies and rectifies gaps in one's own understanding	47	34	-13
9.3	justifies own stance on an issue	47	19	-28
11.1	develops responses which synthesise a range of ideas	47	10	-37

5.6.6 Summary

Comparison of group means calculated using Rasch analysis case estimates suggested that differences existed between student and staff perceptions of the relative *importance*, *difficulty* and *preparedness* of the e-learning competencies. Subsequent MANOVA and univariate ANOVA applied to the *importance*, *difficulty* and *preparedness* data sets, identified a significant difference ($p < .05$) between student and staff groups for both the *difficulty* and *preparedness* perspectives but no significant difference ($p > .05$) for the *importance* perspective.

Proposed analysis of the *difficulty* and *preparedness* data sets using Cook's Distance was unable to proceed due to the Rasch item estimates required for Cook's Distance having item reliabilities less than the acceptable value of 0.7. Consequently, the decision was made to analyse the data using non-parametric techniques.

A non-parametric technique for identifying significant differences between two groups known as the Mann-Whitney test was applied to cumulative percentages data for both student and staff groups, for each the three perspectives. The Mann-Whitney test confirmed the significant results for the *difficulty* and *preparedness* perspective and the non-significant result for the *importance* perspective.

With confirmation of significant differences existing between student and staff groups for both the *difficulty* and *preparedness* perspectives, rank-order comparisons were used to identify those competencies, which due to the size of their rank-order differentials, could be considered as being influential in causing the significant differences identified between student and staff groups.

For the *difficulty* perspective, rank-order comparisons identified three competencies believed to be influential in causing the significant difference between student and staff groups. Next, the ten highest ranked competencies for *difficulty* according to students were examined and differences in opinion between students and staff with regard to the relative *difficulty* of the e-learning competencies were identified. However it was noted that both student and staff groups had previously classified all of the e-learning competencies as 'Easy'. Thus it was considered that the fact that there were differences in opinion between students and staff was likely to be of greater significance than any of the individual differences themselves.

For the *preparedness* perspective, rank-order comparisons identified ten competencies believed to be influential in causing the significant difference between student and staff groups. Three of the e-learning competencies in this group were the three most important competencies. Due to the nature in which the *preparedness* perspective was rated by student and staff groups, the *preparedness* rankings were viewed from three different perspectives. Firstly, examination of ten highest ranked competencies for *preparedness* according to students identified marked differences in perception between students and staff with students ranking themselves higher in preparedness than did staff for a majority of the competencies. Secondly, examination of the ten lowest ranked competencies for *preparedness* according to students also identified some marked differences between students and staff. Critically, a number of the competencies for which students felt the least prepared involved working and interacting with others online and adapting to the e-learning environment. Thirdly, examination of the ten lowest ranked competencies for *preparedness* according to staff also identified marked differences in perceptions between students and staff but also identified a number of competencies for which there was general consensus between student and staff perceptions of relative *preparedness*.

5.7 CONCLUSION

This chapter presented the results and analysis for Phase Two of the study – the external validation of the BARS-EL and survey of stakeholder perceptions. A range of parametric and non-parametric techniques were used to determine: the independence of the performance dimension structure; the relative *importance*, *difficulty*, and *preparedness* of the e-learning competencies; differences between the *importance*, *difficulty*, and *preparedness* perspectives; and differences in the perceptions between student and staff stakeholder groups of the e-learning competencies.

The results showed that the performance dimensions were not independent, rather the e-learning competencies grouped within them were measuring a single underlying construct. It was also found that the e-learning competencies were not of equal *importance*, *difficulty*, or *preparedness* and consequently could be placed in rank-order. Subsequent comparisons of the rankings of the *importance*, *difficulty*, and *preparedness* perspectives identified significant differences amongst the three perspectives. Rank-order comparisons were able to identify sets of competency-pairs believed to be influential in causing the significant differences between the perspectives. Although no significant difference was identified in student and staff perceptions of the relative *importance* of the e-learning competencies, significant differences were identified in student and staff perceptions for both the relative *difficulty* and *preparedness* and of the e-learning competencies. The next chapter provides discussion of the results presented in this chapter.

CHAPTER SIX

PHASE TWO: VALIDATION OF THE BARS-EL AND STAKEHOLDER PERCEPTIONS DISCUSSION

The chapter provides discussion of the results for Phase Two of the study. Discussion is divided into seven sections. The first section deals with discussion of the independence of the performance dimensions. The second, third and fourth sections summarise the results associated with the importance, difficulty, and preparedness of the e-learning competencies respectively. The fifth section discusses the relationships between the *importance*, *difficulty* and *preparedness* perspectives. In the sixth section, differences between stakeholder perceptions of the e-learning competencies are examined. The seventh section provides a conclusion to the chapter.

6.1 INDEPENDENCE OF THE PERFORMANCE DIMENSIONS

Discussion in this section addresses the following research question:

Question 7.1 Can the independence of the performance dimensions developed in accordance with Smith and Kendall's (1963) original procedure be empirically validated?

Factor analysis demonstrated that alternate groupings of the e-learning competencies were possible and it was concluded that the performance dimensions of the BARS-EL were not independent. Subsequent Rasch analysis indicated that the e-learning competencies were measuring a single underlying construct and provided further confirmation that the organisation of the e-learning competencies within the performance dimension structure was not unique.

Based upon these findings, it was concluded that the structure of performance dimensions developed in accordance with Smith and Kendall's (1963) original procedure could not be empirically validated. This suggested that the lack of performance dimension independence was due to factors other than the order in which the performance dimensions and competencies were generated. However, due to the small sample size of the study (n = 35), such a statement is made with caution.

Two possible explanations can be offered as to why the performance dimensions developed in the current study were not independent. Firstly, in contrast to Smith and Kendall's (1963) original BARS methodology, Hybrid BARS adopts an integrated approach to competencies and considers them to be multidimensional in nature. Thus the notion of what constitutes a competency has been expanded and is now different from what was originally conceived by Smith and Kendall. As a consequence, it might not be possible to develop independent performance dimensions for competencies that are multidimensional.

Secondly, Landy (1985), argued that as competencies are developed with the execution of a particular task or role in mind, they should be homogeneous or similar in some respect. Landy referred to this homogeneity as "true halo" (1985, p. 200). For the current study, Landy's 'true halo' was reflected in the Rasch analysis results that showed the e-learning competencies to be unidimensional, in other words, measuring a single, underlying construct. Results from the current study and a previous Hybrid BARS study (e.g., Dickson, 2000), suggest that competencies developed using the Hybrid BARS process are homogenous and as such the practice of grouping competencies into performance dimensions could be considered as an artificial and arbitrary means of organisation.

Irrespective of whether these explanations are valid, doubt still remains over the independence of the performance dimension structure developed using the Hybrid BARS process.

6.2 PERCEPTIONS OF RELATIVE IMPORTANCE

Discussion below addresses the following two research questions:

Question 2.1 Do the major e-learning stakeholders (university students and staff) support the importance of the e-learning competencies identified using the hybrid BARS process?

Question 2.2 What are the relative importance ratings of the e-learning performance dimensions and competencies as perceived by the e-learning stakeholders?

In Phase One of the study, members of two expert panels identified competencies considered essential for effective performance in a university e-learning environment. The e-learning competencies and their associated performance dimensions were then externally validated in Phase Two of the study by e-learning stakeholders at the university. As an initial form of analysis, the performance dimensions and competencies were classified with respect to their perceived level of importance into three groups: 'Essential (must have)', 'Important (should have)', and 'Unimportant'.

For the 16 performance dimensions of the BARS-EL, 15 were considered as 'Essential (must have)', or 'Important (should have)' and one performance dimension was classified as 'Unimportant'. The performance dimension classified as 'Unimportant' was, *develops relationships within the learning community*. This was the first indication in the study that many of the activities involved with working and interacting with others were not to receive widespread support from the e-learning stakeholders. For the 58 competencies identified, 19 were considered as 'Essential (must have)' competencies, 29 were considered as 'Important (should have)', and 10 were considered 'Unimportant'. The competencies considered as 'Unimportant' represented 17% of the total number of competencies identified. A previous Hybrid BARS study by Dickson (2000), reported a value of 11% for competencies rated as 'Unimportant'. Dickson interpreted this result as indication of broad acceptance by the stakeholders of the competencies identified by the expert panels. For the current study, the figure of 17%, being of similar magnitude to the value reported by Dickson, was taken as indication of broad acceptance of the e-learning competencies by e-learning stakeholders at the university.

Despite a reasonable level of overall support for the e-learning competencies, significantly, eight of the ten competencies (80%) considered by stakeholders as being 'Unimportant' were grouped in the *interaction with the e-learning community* category. Significantly, the only performance dimension classified as unimportant: *develops relationships within the learning community*, was also considered to be in this category. So while there was broad acceptance of the e-learning competencies in general, many of the competencies that dealt with working and interacting with others did not receive widespread support from the e-learning stakeholders. Analysis of the relative *importance* ratings of the e-learning stakeholders derived from Rasch analysis provided further evidence of a general lack of support for the e-learning competencies associated with interacting with other members of the e-learning community.

One of the main assumptions of Hybrid BARS is that all competencies identified will be of equal importance (Anshel, 1995). However, the classification of the e-learning competencies into 'Essential (must have)', 'Important (should have)', and 'Unimportant', demonstrated that this was not the case. Subsequent rankings of the e-learning competencies based upon ratings of relative *importance* derived from frequency analysis identified a discernable hierarchy in the e-learning competencies. This hierarchy was confirmed using Rasch analysis, which besides being statistically more robust than frequency analysis, converted the Likert scale data to interval level data. This allowed firmer conclusions to be drawn about the order of the e-learning competencies and the relative strength of the differences between them.

Based upon Rasch analysis rankings (see Table 5.12), the four most important e-learning competencies were: (7.2) *balances work, social, family and study commitments*, (16.1*) reads and writes at an appropriate level*, *(7.1) prioritises competing tasks within the time available, (2.2) plans an appropriate strategy to undertake a task*. The magnitude of the Rasch item estimate for competency 7.2 of 1.03 (SD = 0.50) which was more than two standard deviations from the mean, made this competency significantly more important than the other e-learning competencies. The next three highest ranked competencies, 16.1, 7.1, and 2.2, although having item estimates less than two standard deviations from the mean (0.91, 0.89, and 0.85 respectively), were sufficiently spaced from the next highest ranked competency, (13.3) *selects the appropriate technology tool for the task at hand*, with a Rasch item estimate of 0.65, to be considered significantly important as well. All four competencies had previously been identified in the literature review as being critical for effective performance in a university e-learning environment (Birch, 2002; Kearsley, 2000; Loomis, 2000; Pallof & Pratt, 1999, 2003; Schrum & Hong, 2002). However, the inclusion of these competencies in the BARS-EL not only confirmed their importance but their Rasch item estimates identified them as being the *most* important e-learning competencies.

Two consistent patterns could be identified in the Rasch analysis results. The first was the high *importance* rankings given to competencies in the *management of learning and the e-learning environment* group and *interaction with the learning content* group. In particular, competencies in the *management of learning and the e-learning environment* group were strongly represented in the rankings making up eight of the top ten most important ranked competencies. The second pattern was the lack of widespread support for the e-learning competencies involving interaction with other members of the e-learning community. For the Rasch analysis rankings (see Table 5.12), eight out of the ten lowest ranking competencies were from this group. Inspection of the Rasch analysis rankings revealed that competencies in the *interaction with the e-learning community* group that did rank highly in importance were generally involved with how individual e-learners *responded* to others as opposed to *worked* with others. For example, competencies, *(8.2) responds to others with respect* and *(3.2) provides responses in clear, concise and unambiguous language*, were ranked as more important than competencies *(9.2) contributes new ideas to a discussion*, and (*11.3) works with others to collaboratively construct knowledge*.

The lack of support for competencies involving interaction with members of the e-learning community and the importance placed upon activities focused upon managing the learning and interaction with content suggested that the e-learning stakeholders had a view of e-learning that was not fully consistent with the central ideas of social constructivism. As discussed in Chapter One, from a social constructivist perspective, learning occurs through the interaction, discussion and the sharing of ideas which supports the construction of new knowledge (Yuen & Chow, 2000). However, many of the competencies supporting such principles were considered by the e-learning stakeholder to be relatively unimportant (see Table 5.11). Examples of competencies supportive of social constructivist principles but considered to be unimportant were:

4.1 arranges schedule to allow for regular online sessions;
4.2 seeks interaction with other members of the learning community;
4.3 encourages others to post through positive responses;
8.1 shares personal experiences in responses when relating to topic and others;
8.3 views oneself as a member of the learning community;
9.2 contributes new ideas to a discussion;
9.4 comments upon or critiques a response made by the lecturer;
11.3 works with others to collaboratively construct knowledge.

Subsequent statistical analysis was used to determine whether this view was consistent across all of the e-learning stakeholders or restricted to student or staff groups. Discussion of these findings is presented in Section 6.6.1.

6.3 PERCEPTIONS OF RELATIVE DIFFICULTY

Discussion in this section addresses the following research question:

Question 3.1 What are the relative difficulty ratings of the e-learning performance dimensions and competencies?

Classification of the *difficulty* ratings of the e-learning competencies according to the 'Very Difficult', 'Difficult', or 'Easy' criteria resulted in all of the competencies being classified as 'Easy'. However frequency analysis and Rasch analysis were able to identify a discernable hierarchy with respect to the *difficulty* ratings of the e-learning competencies.

Based upon Rasch analysis rankings (see Table 5.14), the three most difficult e-learning competencies were: *(10.1) able to navigate large bodies of content*, *(10.2) able to distinguish between relevant and irrelevant items*, and *(7.4) works to a disciplined timeframe*. Competency 10.1 was the only competency with a Rasch item estimate greater than two standard deviations from the mean (0.99, SD = 0.46) making it significantly more difficult than the other e-learning competencies. Furthermore, the two most difficult competencies (10.1 and 10.2), and the 9th ranked difficult competency*, (10.3) cross references between sources to determine accuracy*, had all previously been grouped together under the performance dimension, *Employs a range of information skills*. Such a clustering of like competencies ranked relatively highly in difficulty is worthy of note.

Although no consistent patterns emerged from the *difficulty* continuum presented in Table 5.13, a number of generalisations can be made with regard to the *difficulty* rankings of the e-learning competencies. Firstly, e-learning competencies requiring critique or evaluation were typically ranked higher in the difficulty ratings. Examples of such competencies included:

10.2 able to distinguish between relevant and irrelevant items – *ranked 2nd;*
5.2 evaluates a set of search results critically – *ranked 4th;*
10.3 cross references between sources to determine accuracy – *ranked 9th;*
9.4 comments upon or critiques a response made by the lecturer– *ranked 13th;*
5.3 critiques a web site in relation to content – *ranked 15th.*

Secondly, competencies involving the use of some aspect of technology were typically ranked at the lower end of the *difficulty* continuum. For example:

15.1 uses a web browser with skill and purpose – *ranked 48th;*

15.2 uses search engines effectively – *ranked 53rd;*

15.4 downloads and uploads information and resources – *ranked 56th.*

Thirdly, the competency found to be the exception to this pattern was *(13.1) demonstrates knowledge and use of the Learning Management System*, which with a ranking of 36, was considered by the e-learning stakeholders to be relatively more difficult than other competencies involving the use of technology. It would be reasonable to expect students to be well versed in competencies 15.1, 15.2, and 15.4, by the time they reached university-level study. However, such an assumption cannot be made with the use of Learning Management Systems, as students are only likely to have encountered these in more formal e-learning environments such as those provided by universities or training institutions.

Finally, the competency considered to be the least difficult was *(8.2) responds to others with respect,* which with an item estimate greater than two standard deviations from the mean (- 0.94, SD = 0.46), was significantly less difficult than all of the other e-learning competencies. The perceived ease of this competency is a positive sign as the ability to relate to others in e-learning environments has been shown to influence 'social presence' which, as discussed in the literature review, is an important determinant of e-learning effectiveness (Gunawardena, 1995).

6.4 PERCEPTIONS OF RELATIVE PREPAREDNESS

Discussion in this section addresses the following research question:

Question 4.1 What are the relative preparedness ratings of the e-learning performance dimensions and competencies?

Classification of the e-learning competencies according to 'Very Prepared', 'Prepared', and 'Poorly Prepared', (see Table 5.15) indicated an overall low level of perceived student preparedness with no e-learning competencies being identified for which students were considered to be 'Very prepared'. Overall, there were 23 competencies for which students were considered to be 'Prepared' and 35 competencies for which students were considered to be 'Poorly Prepared'.

For the 23 competencies for which students were considered to be 'Prepared', competencies in both the *management of learning and the e-learning environment* and *interaction with the e-learning community* groups were well represented with 11 and 10 competencies in this category respectively. In contrast, there were only two competencies in the *interaction with the learning content* group: *(11.2) forms connections between prior knowledge and new knowledge*, and *(16.2) accesses information from a variety of sources*, for which students were considered to be 'Prepared'.

Inspection of the 11 competencies in the *management of learning and the e-learning environment* group for which students were considered to be 'Prepared' indicated that six of these competencies were related to technology:

1.3 uses technology to support own learning style;
11.4 uses technology to assist in the construction of knowledge;
13.3 selects the appropriate technology tool for the task at hand;
15.1 uses a web browser with skill and purpose;
15.2 uses search engines effectively;
15.4 downloads and uploads information and resources.

Similar to the *difficulty* perspective, it would be likely that these competencies had been acquired by students prior to their university-level studies, hence their relatively high level of preparedness. Again, the notable exception was competency (*13.1) demonstrates knowledge of the Learning Management System*, for which students were considered to be 'Poorly Prepared'. As for difficulty, the low level of student preparedness was likely to be due to students having little or no exposure to Learning Management Systems prior to their university studies.

Inspection of the 35 competencies in the 'Poorly Prepared' category showed that 13 of these competencies fell into the *management of learning and the e-learning environment* group, 11 in the *interaction with the learning content* group, and 11 in the *interaction with the e-learning community* group. Although no consistent pattern could be seen amongst the competencies for which students were considered to be poorly prepared, many of the competencies involved activities such as planning, analysing, critiquing, and evaluating.

Based upon Rasch analysis rankings (see Table 5.17), the three e-learning competencies with the highest level of student *preparedness* were: *(15.4) downloads and uploads information and resources*, (*8.2) responds to others with respect*, *(6.1) seeks information through either own enquiries or the questioning of others*. None of the e-learning competencies at the higher end of the ranking continuum had Rasch item estimates of more than two standard deviations from the mean. Consequently, there were no competencies for which students were considered to be significantly more prepared than others. However, at the lower end of the rankings, two competencies, *(4.2) seeks* *interaction with other members of the learning community*, and *(9.4) comments upon or critiques a response made by the lecturer,* had Rasch item estimates greater than two standard deviations from the mean (- 1.07 and – 1.23 respectively, SD = 0.48), suggesting that students were significantly under prepared for these two competencies.

The significantly low *preparedness* ranking for competency *(9.4) comments upon or critiques a response made by the lecturer*, could be due to reasons other than a lack of student preparedness. For example, although e-learning environments are generally portrayed as being open and democratic, power relations do exist online (Anderson & Simpson, 2008) and a lecturer's role has been shown to have an influence on student participation online (Anderson, 2006). The power relations between lecturers and students are not equal and as a consequence, students may be unwilling to critique someone who may ultimately be making judgments of their performance. Although further discussion of this is beyond the scope of the thesis, it needs to be acknowledged that such power relations do exist – not only between students and lecturers but also between students and other students (Anderson & Simpson, 2008). Furthermore, these power relations need to be taken into account particularly for e-learning environments developed in accordance with social constructivist principles in which interaction and collaboration with others is seen as a critical part of the learning process.

Rasch analysis rankings (see Table 5.17) also confirmed the lack of preparedness of e-learning competencies falling into the *interaction with the learning content* group. Only four competencies from this group: *(11.2) forms connections between prior knowledge and new knowledge* – ranked 11th, *(10.1) able to navigate large bodies of content* – ranked 14th, *(16.4) presents information in a variety of formats* – ranked 20th, and *(16.1) reads and writes at an appropriate level* – ranked 26th, appeared in the top 30 rankings. Many of the competencies from the *interaction with the learning content* group at the lower end of the *preparedness* continuum again, involved activities associated with critiquing and evaluating.

Similar to the *difficulty* perspective, the e-learning competencies in the *interaction with the e-learning community* group that focused on how students *responded* to others tended to be ranked higher in preparedness than those competencies dealing with how students *worked* with others. The most obvious example of this disparity was between competency *(8.2) responds to others with respect* (ranked 2nd), compared to competency *(4.2) seeks interaction with other members of the learning community* (ranked 57th).

6.5 RELATIONSHIPS BETWEEN THE PERSPECTIVES

For the current study, assessment of perspective differences was undertaken in order to determine whether any statistically significant relationships could be identified between the following perspective-pairs:

- *importance – difficulty;*
- *importance – preparedness;*
- *difficulty – preparedness.*

Discussion of the results for each of these perspective-pairs is given below.

6.5.1 Importance versus Difficulty

Discussion in this section addresses the following research question and hypothesis:

Question 5.1	Is there any relationship between the perceived importance of the e-learning competencies and their perceived level of difficulty?
Hypothesis 1	*There will be no significant difference between the relative importance of the e-learning competencies and the relative difficulty in performing them.*

ANOVA confirmed that a significance difference ($p < .05$) existed between the relative *importance* and *difficulty* of the e-learning competencies. Thus the null hypothesis as presented in Hypothesis 1 was rejected.

Subsequent analysis using Cook's Distance was unable to identify any one particular competency or sets of competencies as being influential in causing the significant difference between the two perspectives. Consequently, it was determined that all of the competencies were acting together to cause the significant difference identified by ANOVA.

Rank-order differentials between corresponding competencies of the two perspectives (see Table 5.21) were used to identify 11 competencies which, based upon the size of the difference between the rankings, were considered to have had the most notable effect on the significant difference between the *importance* and *difficulty* perspectives. Re-ordering the competencies according to the *importance* rankings indicated that no clear relationship could be determined between a competency's *importance* ranking and its corresponding *difficulty* rating. This reflects the findings of an earlier Hybrid BARS study by Jessup and Webb (1994), who found no overall relationship between the importance and difficulty ratings of competencies developed for teacher skills of classroom management and discipline. As for the current study, Jessup and Webb found that competencies rated high in importance rated both high and low in difficulty. In fact in their study, Jessup and Webb found that the competency considered being the most important was considered by the stakeholders surveyed to be the least difficult.

Re-ordering the rank-order differentials according to the *importance* rankings (see Table 5.22) indicated that many of the e-learning competencies considered the most important had a rank-order differential of 31 or more places between their *importance* and *difficulty* ratings – meaning they were considered by stakeholders to be relatively easy to execute. These competencies were:

16.1 reads and writes at an appropriate level – *ranked 2nd in importance and 52nd for difficulty;*

2.2 plans an appropriate strategy to undertake a task – *ranked 4th in importance and 35th for difficulty;*

15.2 uses search engines effectively – *ranked 6th in importance and 54th for difficulty,*

8.2 responds to others with respect – *ranked 9th in importance and 57th for difficulty;*

15.1 uses a web browser with skill and purpose – *ranked 10th in importance and 45th for difficulty;*

15.4 downloads and uploads information and resources – *ranked 10th in importance and 56th for difficulty.*

Examination of these e-learning competencies showed them to be competencies that would be expected to be well developed in students by the time they reached university-level study.

Although differences between the relative *importance* and *difficulty* ratings of the e-learning competencies were shown to be statistically significant, no definitive statement could be made about the relationship between a competency's relative *importance* and its degree of *difficulty*. Simply, there were important competencies that were both easy and difficult to perform. However, of practical significance to the study, were four competencies considered by the e-learning stakeholders as being both important and difficult to perform namely:

7.2 balances work, social, family and study commitments – *ranked 1st in importance and 9th for difficulty;*

7.1 prioritises competing tasks within the time available – *ranked 3rd in importance and 11th for difficulty;*

2.1 identifies the requirements necessary to complete a task – *ranked 7th for importance and 5th for difficulty;*

11.2 forms connections between prior knowledge and new knowledge – *ranked 13th in importance and 10th for difficulty.*

Both competencies 7.2 and 7.1 dealt with issues of *time management*. Competency 2.1 was associated with *student autonomy* and competency 11.2 represented a process common to *reflection*. Time management, student autonomy and reflection were identified in the literature review as being important. However, the current study reinforced both the importance of these competencies and demonstrated that e-learning stakeholders considered them as being relatively difficult to perform.

6.5.2 Importance versus Preparedness

Discussion in this section addresses the following research question and hypothesis:

Question 5.2 Is there any relationship between the perceived importance of the e-learning competencies and the level of preparedness of students in performing them?

Hypothesis 2 There will be no significant difference between the relative importance of the e-learning competencies and the relative preparedness of students in performing them.

ANOVA confirmed that a significance difference ($p < .05$) existed between the relative *importance* and *preparedness* of the e-learning competencies. Thus the null hypothesis as presented in Hypothesis 2 was rejected.

Analysis using Cook's Distance was unable to identify any one particular competency or sets of competencies as being influential in causing the significant difference between the two perspectives. Consequently, it was determined that all of the competencies were acting together to cause the significant difference identified by ANOVA.

Rank-order differentials between competency-pairs of the two perspectives (see Table 5.23) identified eight competencies which, based upon the size of the difference between the rankings, were considered to have had a notable effect on the significant difference between the *importance* and *preparedness* perspectives. When the rank-order differentials were re-ordered according the *importance* rankings (see Table 5.24), what emerged was that the five competencies considered to be the most important were also associated with relatively low levels of student preparedness. These five competencies were:

7.2 balances work, social, family and study commitments – *ranked 1st in importance and 46th for preparedness;*

16.1 reads and writes at an appropriate level – *ranked 2nd in importance and 31st for preparedness;*

7.1 prioritises competing tasks within the time available – *ranked 3rd in importance and 26th for preparedness;*

2.2 plans an appropriate strategy to undertake a task – *ranked 4th in importance and 44th for preparedness;*

13.3 selects the appropriate technology tool for the task at hand – *ranked 5th in importance and 31st for preparedness.*

Two e-learning competencies in the above list worthy of further comment are competency 16.1, *reads and writes at an appropriate level*, and competency 13.3, *selects the appropriate technology tool for the task at hand*. Firstly, for competency 16.1, students were perceived as being under prepared for the level of reading and writing expected of them for university-level studies. This is a common problem as many university students struggle with academic writing and discourse (Lea & Street, 2006; van der Meer & Scott, 2008). Secondly, although students were generally considered well prepared in the use of technology, the low *preparedness* ranking of competency 13.3 indicated that students were not perceived to be prepared in selecting the most appropriate technology tool for any given situation. Closer inspection of this competency showed it to be more involved than simply using the technology as it included elements of judgment and decision making. Competencies with similar characteristics had previously been associated with relatively low levels of student preparedness (see Section 6.4).

6.5.3 Difficulty versus Preparedness

Discussion in this section addresses the following research question and hypothesis:

Question 5.3 Is there any relationship between the perceived difficulty of the e-learning competencies and the level of preparedness of students in performing them?

Hypothesis 3 *There will be no significant difference between the relative difficulty of the e-learning competencies and the relative preparedness of students in performing them.*

ANOVA confirmed that a significant difference ($p < .05$) existed between the relative *difficulty* and *preparedness* of the e-learning competencies. Thus the null hypothesis as presented in Hypothesis 3 was rejected.

Analysis, using Cook's Distance was unable to identify any one particular competency or sets of competencies as being influential in causing the significant difference between the two perspectives. Consequently, it was determined that all of the competencies were acting together to cause the significant difference identified by ANOVA.

Rank-order differentials between corresponding competencies of the two perspectives (see Table 5.25) identified 18 competencies considered to have had the most notable effect on the significant difference between the *difficulty* and *preparedness* perspectives. Re-ordering the competencies according the *difficulty* rankings (see Table 5.26) gave the impression that the more difficult competencies were associated with lower levels of student preparedness. However, the Pearson Correlation Coefficient calculated for the *difficulty-preparedness* perspective-pair did not identify any statistically significant correlations between these two perspectives.

The competency with the greatest discrepancy between *difficulty* and *preparedness* rankings was *(5.2) evaluates a set of search results critically*, which ranked 4th in *difficulty* and 52nd in *preparedness*. This competency, similar to competency 13.3 discussed above, involved more than simply using the technology and included elements of critiquing and decision making. Another competency with a large rank-order differential was competency 5.3, *critiques a web site in relation to content* – with a *difficulty* ranking of 15th and a *preparedness* ranking of 52nd – was also a technology-based competency with the associated element of critiquing.

Based upon the evidence presented above, the conclusion was drawn that competencies, which dealt with aspects of technology with added elements such as critiquing or making judgments, were associated with relatively higher levels of difficulty and relatively lower levels of student preparedness. However, further inspection of Table 5.26 suggested that this tendency was not restricted to competencies associated with technology but for competencies dealing with elements of analysis, decision making, judgement and critique in general. For example competency 10.2, *able to distinguish between relevant and irrelevant items* – ranked 3rd in difficulty and 41st for preparedness.

Although this finding might not have been significant in itself, when considered in the light of similar findings presented in Section 6.3, *Perceptions of Relative Difficulty* and Section 6.4, *Perceptions of Relative Preparedness*, the picture began to emerge that e-learning competencies that dealt with activities such as: analysing synthesising, decision making, critiquing, and evaluating, which collectively are considered as *critical thinking skills* (Cowley, 2004; McGregor, 2007), were generally perceived by the e-learning stakeholders as being difficult and were often associated with relatively low levels of student preparedness. Despite the increasing importance of critical thinking skills, evidence suggests that university students' abilities in this area to be in decline (Geersten, 2003). Findings from the current study suggested that critical thinking skills were problematic for students at the study site as well.

6.6 STAKEHOLDER PERCEPTIONS OF THE COMPETENCIES

Assessment of stakeholder differences was undertaken in order to determine whether any statistically significant relationships could be identified between student and staff perceptions of the relative *importance*, *difficulty*, and *preparedness* of the e-learning competencies. Discussion of each perspective is presented below.

6.6.1 Importance perspective

Discussion in this section addresses the following research question and hypothesis:

Question 6.1 Do e-learning stakeholders (university students and staff) perceive the same relative importance for the e-learning performance dimensions and competencies?

Hypothesis 4 *There will be no significant difference in perceptions between university students and staff in the relative importance ratings of the performance dimensions and competencies.*

Both Univariate ANOVA and the Mann-Whitney test indicated that there was no significant difference ($p > .05$) between student and staff relative *importance* ratings of the e-learning competencies. Thus the following null hypothesis as presented in Hypothesis 4 was accepted.

Student and staff respondents for the external validation survey were drawn from across all four faculties of the university and represented a wide diversity of backgrounds. Despite this diversity, the non-significant result indicated a consensus of opinion between student and staff stakeholders in their perceptions of relative *importance* of the e-learning competencies. Therefore, the classification and rankings according to importance by stakeholders (see Section 6.2) was considered an accurate portrayal of the perceptions – or the commonly held view – of all the e-learning stakeholders surveyed and not the artefact of one set of opinions dominating over the other and distorting the results.

Previously, rankings by the e-learning stakeholders of the e-learning competencies according to relative *importance* (see Section 6.2) indicated that while there was broad acceptance of the e-learning competencies in general, many of the competencies that dealt with interaction with others and considered important to an e-learning environment built upon social constructivist principles, failed to receive widespread support from e-learning stakeholders. Critically, the low importance placed upon these competencies was considered as being consistent across both student and staff stakeholder groups.

Whether the low importance placed upon competencies involved with interaction with others was peculiar to the study site and whether it still persists, are questions worthy of further investigation.

6.6.2 Difficulty perspective

Discussion in this section addresses the following research question and hypothesis:

Question 6.2 Do e-learning stakeholders (university students and staff) perceive the same relative difficulty for the e-learning performance dimensions and competencies?

Hypothesis 5 *There will be no significant difference in perceptions between university students and staff in the relative difficulty ratings of the performance dimensions and competencies.*

Both Univariate ANOVA and the Mann-Whitney test identified a significant difference ($p < .05$) between student and staff relative *difficulty* ratings of the e-learning competencies. Thus the null hypothesis as presented in Hypothesis 5 was rejected.

The planned analysis of both the *difficulty* and *preparedness* perspectives using Rasch item estimates and Cook's Distance was unable to proceed due to low item reliability values of the Rasch item estimates calculated for the student and staff groups (see Table 5.31). Consequently, analysis was undertaken using frequency analysis and rank-order comparisons. As the data generated from frequency analysis was not as statistically robust as data generated from Rasch analysis, any interpretation of the results for both the *difficulty* and *preparedness* perspectives discussed in this section must be made with caution.

Rank-order differentials between student and staff rankings of the relative *difficulty* of the e-learning competencies (see Table 5.33) identified three competencies considered to be influential in causing the significant difference between the student and staff groups. However, while these competencies might have had a *statistically significant* impact between student and staff groups, in order to identify competencies of *practical significance* to the study, the rank-order differentials were reorganised to provide the top ten ranked competencies for *difficulty* according to students and the corresponding rankings of staff (see Table 5.34). When ranked in this fashion, for eight of the eleven competencies identified, students gave higher *difficulty* rankings than did the staff.

Two notable competencies with large discrepancies between student and staff perceptions of difficulty were:

11.3 works with others to collaboratively construct knowledge – *ranked 1st in difficulty by students and 32nd in difficulty by staff;*

4.2 seeks interaction with other members of the learning community – *ranked 9th in difficulty by students and 32nd in difficulty by staff.*

Both competencies involved interaction with other members of the e-learning community and competency 11.3 was the competency ranked as being the most difficult by students. Such a difference in perception between student and staff for competencies involving interaction and collaboration with others – both of which are considered critical for learning environments developed in accordance with social constructivist principles – should be considered significant. However, this statement needs to be tempered with the fact that the rank-order differentials were calculated using frequency analysis and as such no definitive conclusions could be drawn with respect to the strength of any difference in perception between students and staff. However, on the face of the evidence, it appeared that students perceived working and interacting with others online to be more difficult than what was perceived by staff.

6.6.3 Preparedness perspective

Discussion in this section addresses the following research question and hypothesis:

Question 6.3 Do e-learning stakeholders (university students and staff) perceive the same relative preparedness for the e-learning performance dimensions and competencies?

Hypothesis 6 *There will be no significant difference in perceptions between university students and staff in the relative preparedness ratings of the performance dimensions and competencies*

Both Univariate ANOVA and the Mann-Whitney test identified a significant difference ($p < .05$) between student and staff relative *preparedness* ratings of the e-learning competencies. Thus the null hypothesis as presented in Hypothesis 6 was rejected.

Rank-order differentials between student and staff rankings of the relative *preparedness* of the e-learning competencies (see Table 5.35) were used to identify ten competencies considered to be influential in causing the significant difference between student and staff groups. Examination of the competencies in this group showed that for seven out of these ten competencies students rated themselves higher with regard to preparedness than did staff. However, as these rank-order differentials were calculated using frequency analysis, interpretation of any difference of opinion between students and staff need to be made with caution.

One competency of note that was rated by staff at a higher level of preparedness than students was 7.2, *balances work, social, family and study commitments.* This competency was significant as it was one of three competencies with the largest rank-order differential (38 places) plus it was the competency previously ranked as the most important. As this competency dealt with personal circumstances, it was assumed that students would be in a better position than staff to make an accurate judgement of their level of relative preparedness for this competency. Critically, students felt very poorly prepared for what was considered to be the most important e-learning competency.

Included in the list of competencies with large rank-order differentials were the competencies considered to be second and fourth most important: (16.1) *reads and writes at an appropriate level*, and (2.2) *plans an appropriate strategy to undertake a task*. For these two competencies students rated themselves high in preparedness while staff rated overall student preparedness as low. As for competency 7.2, in order to make an assessment of these two competencies, it was a matter of determining which of the two stakeholder groups might be in the better position to make the most appropriate judgment. For these two competencies – one dealing with literacy requirements (16.1), and the other dealing with planning and strategy (2.2) – it was assumed that staff were in the better position to make this judgment. Even if the student group had made an accurate appraisal of their own level of preparedness for these two competencies, the fact that staff considered students on the whole to be poorly prepared for these two critical competencies was considered as being significant.

Reorganisation of the student and staff *preparedness* rank-order differentials from more practical perspectives (see Tables 5.36, Tables 5.37, and Tables 5.38) raised three issues considered to be worthy of discussion.

Firstly, large discrepancies were found between student and staff perceptions of student *preparedness* for four 'academic-type' competencies considered fundamental for university-level studies in general (see Table 5.36). These competencies were:

16.1 reads and writes at an appropriate level – *ranked 2nd in preparedness by students and 33rd in preparedness by staff;*

2.1 identifies the requirements necessary to complete a task – *ranked 6th in preparedness by students and 44th in preparedness by staff;*

3.2 provides responses in clear, concise and unambiguous language – *ranked 10th in preparedness by students and 44th in preparedness by staff;*

11.1 develops responses which synthesise a range of ideas – *ranked 10th in preparedness by students and 47th in preparedness by staff.*

As for the previous disparities in rankings, it was a matter of determining which stakeholder group was in the better position to make the most appropriate judgment of the overall situation. In this instance, staff would have a clearer understanding of the requirements of their disciplines and where current levels of student preparedness were positioned in relation to these requirements. The difference in perceptions between the two groups might be due to these requirements not being clearly articulated to students. The implication is that if students are not fully aware of the level of performance that is required of them and importantly, where their current level is in regard to this expected level of performance, the quality of their learning may be compromised. According to Hill (2007), lecturers need to explore their own constructs of "goodness" (p. 59) and make these explicit to students.

Secondly, the inclusion in the list of competencies for which students felt least prepared (see Table 5.37) of three competencies: *(4.1) arranges schedule to allow for regular online sessions*, *(4.2) seeks interaction with other members of the learning community*, and *(4.3) encourages others to post through positive responses*, indicated that student did not feel well prepared for working and interacting with others online. The inclusion in this list of competency *(1.2) adapts learning style to the e-learning environment*, suggested that students also might be struggling with the transition to e-learning environments.

Thirdly, inspection of the competencies for which staff considered students to be the least prepared (see Table 5.38), showed that competencies associated with critical thinking skills (i.e., competencies 3.3, 5.2, and 11.1) had the most marked differences in perceptions between students and staff. As for the four 'academic-type' competencies from Table 5.36 mentioned above (i.e., competencies 16.1, 2.1, 3.2, and 11.1), students rated themselves with a higher level of preparedness than did staff. Again, students might not be fully aware of the level of preparedness expected of them for the appropriate execution of these competencies.

6.7 CONCLUSION

The external validation survey used to validate the performance dimensions and e-learning competencies according to the *importance* ratings of the e-learning stakeholders also proved a useful means of collecting data on the relative *difficulty* and *preparedness* of the e-learning competencies. Subsequent analysis of the *importance*, *difficulty*, and *preparedness* data provided answers to a range of research questions and hypotheses with respect to the independence of the performance dimension, the relative *importance*, *difficulty* and *preparedness* of the e-learning competencies, the relationships between these three perspectives, and the differences in perceptions between the two e-learning stakeholder groups.

Discussion in this chapter identified a number of issues and advanced a number of proposals that have implications for e-learning, the study site, and the Hybrid BARS methodology. All of these are discussed under the relevant sections in the *Conclusion* chapter that follows.

CHAPTER SEVEN

CONCLUSION

The aim of this study was to identify the competencies required for effective performance in a university e-learning environment. The purpose of this chapter is to summarise the substantive findings of the two phases of the study and to examine the limitations and implications of the research that was undertaken. To achieve this, the chapter is divided into seven sections. The first section discusses possible limitations of the study. The second section provides a summary of the study findings. The third, fourth and fifth sections examine the implications of the study findings as they relate to e-learning, the study site, and the Hybrid BARS methodology respectively. In the sixth section, recommendations for further research are presented. The seventh section concludes the study.

7.1 POSSIBLE LIMITATIONS OF THE STUDY

In Chapter Three, the research design of the study was evaluated within the framework of the twin issues of validity and reliability. In this evaluation, a number of procedures were adopted to minimise possible threats to validity and reliability. Despite such precautions, three issues associated with the context and scope of the study, nature of the study sample, and the design of the external validation questionnaire were considered to be problematic. Discussion of these three issues is provided below.

7.1.1 Context and scope of the study

The performance dimensions and e-learning competencies of the BARS-EL were developed specifically for learning mediated by a Learning Management System in a university e-learning environment in accordance with social constructivist principles. This level of specificity was a requirement of the Hybrid BARS process to ensure that the competencies identified were an accurate and comprehensive reflection of all aspects of effective performance. However, this process had the potential to limit the study by restricting the applicability of the e-learning competencies to the site where they were developed.

To ensure application of the e-learning competencies beyond the study site, the context of the study – a university Learning Management System – was chosen deliberately, not simply because one was in use at the study site, but because Learning Management Systems remain the most common means of delivery of e-learning in universities (Coates et al., 2005; Siemens, 2006). Importantly, the use of Learning Management Systems in universities is expected to increase in the future (Bonk, 2004a). The choice of learning theory in which to situate the e-learning competencies – social constructivism – was also deliberate, as this theory is widely accepted as being the most appropriate learning theory for informing e-learning practice (Bauer et al., 2000).

However, it must be acknowledged that the scope of the study – within a single institution – could potentially limit the study's findings. This is because other factors, such as the culture of teaching and learning unique to the institution, could have influenced the view of e-learning held by the study participants. For this reason, a broader assessment of the e-learning competencies across other institutions would be warranted. This will be discussed further in Section 7.6 – Recommendations for further research.

7.1.2 Nature of the study sample

Two issues associated with the nature of the study sample were identified as possible limitations to the study. These were the size and representativeness of the study sample.

Size of the study sample

There has been no definitive assessment in the Hybrid BARS literature of what constitutes an adequate sample size for the external validation of the performance dimensions and competencies. The highest number of participants identified in the literature was 212 used by Anshel (1995) to validate competencies for basketball refereeing, while the lowest was 16 participants used by Webb et al. (1994), to validate competencies for Sporting Development Officers. Critically, Webb et al. did not report any untoward impact on the results of their study due to the relatively small sample size. Therefore, from the perspective of the Hybrid BARS methodology, the size of the sample for the current study (n = 35) was within the parameters of sample sizes used in previous Hybrid BARS studies.

With respect to the research design, the relatively small sample size required two modifications to be made to the stated methodology and Data Analysis Plan. The first modification was made in the factor analysis procedures used to validate the independence of the performance dimensions. Due to the sample size, it was not possible to identify factor solutions for all of the 16 performance dimensions at the one time as was intended. As a compromise, the performance dimensions were analysed as four separate sets. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity (BTS) indicated that all four sets of performance dimensions were suitable for factor analysis, although the values for KMO were just within the acceptable range. Despite the small population sample, factor analysis was able to extract factor solutions which, according the respective factor loadings, were considered to be reliable. The results from factor analysis indicated that the performance dimensions of the BARS-EL were not independent. This finding was then confirmed using Rasch analysis.

The second modification concerned the data analysis procedures used for the assessment of stakeholder differences. Due to the small sample size, item reliability indices for the Rasch item estimates were below the acceptable value that would guarantee a reproducible item hierarchy. Consequently, non-parametric techniques were used to analyse the student and staff data. The Mann-Whitney test used showed that significant differences in perceptions existed between student and staff groups for the *difficulty* and *preparedness* perspectives but not for the *importance* perspective. Results from the Mann-Whitney test (see Section 5.6.4) confirmed previous results obtained from the parametric technique, ANOVA.

For both modifications that were made, the results were subsequently confirmed by other statistical techniques known to be more robust with regard to sample size. Consequently, it was concluded that there were no undue threats to validity or reliability as a result of the modifications made to the original methodology.

Representativeness of the study sample

Another possible limitation was the lack of undergraduate students taking part in the external validation survey as a result of there being no undergraduate units offered at OL3 (*Online Level Three – Fully Online*), during the external validation phase of the study. However a *purposive sampling* technique was employed to ensure the study sample was relevant to the research questions being answered. As such, while it may have been desirable to have undergraduate students taking part in the external validation survey, their absence was not considered critical to the outcomes of the study. Rather, what was critical was that participants were considered to be 'expert' meaning they had knowledge, familiarity, expertise, or previous experience with e-learning. However, an undergraduate student was included as a member of one of the expert panels used to identify the e-learning competencies in Phase One of the study. Consequently, e-learning from an undergraduate perspective was included in the development of the BARS-EL.

7.1.3 Design of the external validation questionnaire

A potential limitation of the study was identified in the use of drop down menus for the external validation survey. Care was taken to ensure that the questionnaire used in the survey was a usable document that respondents could answer accurately and efficiently. Drop down menus were used for the Likert scale ratings of the relative *importance*, *difficulty* and *preparedness* of items to reduce horizontal space requirements. At the time the questionnaire was being developed, no research was found suggesting that the use of drop down menus was unsuitable nor were any problems with them identified during the questionnaire pilot. However, since the implementation of the external validation survey, a study investigating the use of drop down menus in web-based surveys found that the use drop down menus can lead to higher item non-response and longer response times (Healey, 2007). Although one respondent for the current study failed to complete all of the items on the external validation survey, there was no evidence that suggested the use of drop down menus was the cause of this non-response. However, such a possibility cannot be excluded. There was also no evidence that suggested the use of drop down menus may have stopped potential respondents from completing the survey but as before, this possibility cannot be excluded. Based upon the findings of Healey (2007), it would be wise to re-assess the use of drop down menus in future web-based surveys.

7.2 SUMMARY OF FINDINGS

As the study was implemented in two phases each with a differing objective and using a different set of participants, the purpose of this section is to consolidate the findings of Phase One and Phase Two of the study. The findings of the study can be grouped into four broad themes:

- nature of the e-learning competencies;

- stakeholder perceptions of the relative *importance*, *difficulty*, and *preparedness* of the e-learning competencies;
- differences between the three perspectives;
- differences in stakeholder perceptions of the e-learning competencies.

Discussion of each theme is provided below.

7.2.1 Nature of the e-learning competencies

The Hybrid BARS process was used to identify 58 competencies grouped in 16 performance dimensions considered to be essential for effective performance in a university e-learning environment mediated by a Learning Management System. The performance dimensions identified could be classified into four broad groups: intrapersonal, interpersonal, strategies and practices, and technological.

Critically, given the context of the study only two of the 16 performance dimensions identified related exclusively to the use of technology. Inspection of the individual e-learning competencies showed that 22 of the 58 competencies were either related specifically to the use of technology or had been reconceptualised for the e-learning context. The remaining 36 competencies and 14 performance dimensions encompassed a range of practices which generally could be considered as essential for learning situated within the social constructivist paradigm. On the face of the evidence, it appears that good learners make good e-learners. However such a statement requires further substantiation.

The e-learning competencies identified using Hybrid BARS included, either directly or indirectly, all of the competencies identified in the literature review. Six competencies were identified by the study that were either new or significantly different from what had been identified previously. Three of these competencies involved the practice of critiquing, one dealt with making allowances for the virtual nature of the e-learning environment, and the remaining two involved making the most effective use of teaching staff.

Systematic studies in the area of e-learning competencies with any form of empirical rigour remain rare (de la Teja & Spannaus, 2008). The e-learning competencies identified by the Hybrid BARS process presented a profile of the e-learner in a greater degree of depth and detail than what had been provided previously. Critically, as the competencies were written in multidimensional behaviour specific terms, they can be used as the basis for future observation, assessment, development and refinement of e-learners. This makes the e-learning competencies identified by the study of practical benefit. Furthermore, having been developed within the context of a Learning Management System and aligned with social constructivist principles, the e-learning competencies identified should have relevance and utility beyond the scope of the study site.

7.2.2 Stakeholder perceptions of Importance, Difficulty and Preparedness

Likert scale data collected during the external validation survey were analysed using frequency analysis and Rasch analysis. Discernable hierarchies for the *importance*, *difficulty* and *preparedness* perspectives were indicated by factor analysis and subsequently confirmed and quantified using Rasch analysis.

Based upon Rasch item estimates, the most important e-learning competency as perceived by the e-learning stakeholders was *(7.2) balances work, social, family and study commitments*. This competency, with a Rasch item estimate more than two standard deviations from the mean, indicated that it was significantly more important than the other e-learning competencies. A consistent pattern found in the relative *importance* rankings of the e-learning was that competencies dealing with the management of learning and interaction with content were generally considered to be more important than competencies associated with interaction with others. A further pattern was identified in competencies involved with interaction with others, with competencies concerned with the manner in which individual students responded to others generally being ranked higher in importance than those competencies concerned with how individual students worked with others. When all of these factors were taken into consideration, two conclusions were drawn. Firstly, as shown by the ratings of relative *importance* of the e-learning competencies, e-learning stakeholders at the study site had a view of e-learning that was different from members of the expert panels who developed the competencies. Secondly, the view of e-learning held by stakeholders was not fully consistent with the principles of social constructivism.

With respect to the relative *difficulty* of the e-learning competencies, although all of the competencies were classified as ‘Easy’, a discernable hierarchy was identified using frequency analysis and Rasch analysis. Based upon Rasch analysis rankings the e-learning competency considered to be the most difficult was *(10.1) able to navigate large bodies of content*. This competency, with an item estimate greater than two standard deviations from the mean, indicated that it was considered to be significantly more difficult than the other e-learning competencies. However, as all of the competencies were classified as 'Easy', not a great deal of significance should be placed upon the relative *difficulty* of this competency.

Two generalisations were made with respect to the relative *difficulty* of the e-learning competencies. Firstly, competencies requiring some form of critique or evaluation tended to be ranked higher in terms of difficulty. Secondly, competencies associated with the use of technology were generally ranked lower in terms of difficulty. Significantly, the one exception to this pattern was competency *(13.1) demonstrates knowledge and use of the Learning Management System*, which was considered by stakeholders to be relatively more difficult than other technology-related competencies.

Ratings according to *preparedness* suggested an overall low level of perceived student preparedness for the e-learning competencies. Based upon Rasch analysis rankings, the e-learning competency with the highest level of student *preparedness* was *(15.4) downloads and uploads information and resources*. Unlike the highest ranking competencies for the *importance* and *difficulty* perspectives, this competency was not identified as being significantly higher in preparedness than any of the other competencies.

Two patterns were detected in the *preparedness* results. Firstly, many of the competencies concerned with how students interacted with content were consistently ranked at the lower end of the *preparedness* continuum. Secondly, competencies associated with how students responded to others were typically ranked higher in *preparedness* than those competencies associated with how students worked with others. A similar pattern was also identified for the *difficulty* perspective.

7.2.3 Differences between the perspectives

Statistically significant differences ($p < .05$) were found to exist between the three perspectives of *importance*, *difficulty* and *preparedness*. With respect to the *importance* and *difficulty* perspectives, no consistent pattern could be identified between a competency's relative *importance* and its degree of difficulty. Comparisons of these two perspectives showed that some important competencies were considered as being easy to perform, while others were considered difficult to perform. Of practical significance to the study, was the identification of four competencies ranked high in importance and high in difficulty. Two of these competencies involved aspects of time management, with the remaining two competencies associated with student autonomy and reflection. Significantly, the competency identified as the most important, *(7.2) balances work, social, family and study commitments*, was also considered by e-learning stakeholders as being one of the most difficult.

The critical finding with respect to the *importance* and *preparedness* perspectives was the relatively low levels of student preparedness for the five e-learning competencies considered to be the most important. The inclusion of competency *(7.2) balances work, social, family and study commitments*, in this group was notable due to its relatively high difficulty rating. Thus, the competency considered to be the most important was also one of the most difficult and one for which the students were considered to be least prepared.

For the *difficulty* and *preparedness* perspectives, it was noted that competencies involved with activities associated with critical thinking skills such as analysing synthesising, decision making, critiquing and evaluating, were often ranked higher in terms of difficulty and ranked lower in preparedness.

7.2.4 Differences in stakeholder perceptions of the e-learning competencies

Statistically significant differences ($p < .05$) were identified between student and staff stakeholder perceptions of the *difficulty* and *preparedness* perspectives but not for the *importance* perspective ($p > .05$).

The non-significant result for the *importance* perspective was taken as evidence of a consensus between student and staff stakeholders in their perception of relative *importance* of the e-learning competencies. Considered in this light, the earlier conclusion that e-learning stakeholders had a view of e-learning that was not fully consistent with the principles of social constructivism, was considered as being a consistent view held both by student and staff stakeholders at the study site.

Interpretation of the differences in perceptions between students and staff stakeholders with respect to the *difficulty* and *preparedness* perspective had to be made with caution as analysis was undertaken using ordinal level frequency analysis data. For the *difficulty* perspective, large discrepancies were noted between student and staff perceptions of the relative *difficulty* of many of the competencies. In particular, competencies associated with working and interacting with others online were considered by students as being more difficult than by staff. Significantly, from a social constructivist perspective, the competency considered by students as being the most difficult was *(11.3) works with others to collaboratively construct knowledge*. Staff however, ranked this competency lower in terms of difficulty.

Marked discrepancies also existed between student and staff stakeholder perceptions of the relative *preparedness* of the e-learning competencies. In many instances, student perceptions of preparedness were higher than the perceptions of staff. Such disparities could be due to students not being fully aware of the level of performance expected of them at the university-level. Another critical finding was that several of the competencies for which students felt the least prepared involved working and interacting with others online and adapting their learning styles to the e-learning environment. Considering this finding in the light of differences in student and staff perceptions of the difficulty of the e-learning competencies suggested that students found working, interacting and collaborating online to be relatively difficult and students felt that they were under prepared for performing these types of activities. Furthermore, staff might not be fully appreciative of the challenges students faced working in university e-learning environments.

7.2.5 Summary

The identification and subsequent analysis of the e-learning competencies with respect to relative *importance*, *difficulty* and *preparedness* was able to provide a profile of the e-learner and present a perspective of e-learning that has hitherto been unavailable. Furthermore, findings of the current study demonstrated that the e-learning competencies were not of equal importance or difficulty, nor did students execute them with the same level of preparedness. The future redressing of the imbalances with respect to the importance, difficulty, and preparedness of the e-learning competencies offers the potential to improve the experience of e-learning for both students and staff and lead to more positive learning outcomes in university e-learning environments.

7.3 IMPLICATIONS FOR E-LEARNING

The implications of the results of this study for e-learning are largely dependent upon the degree to which the findings of the study can be extrapolated beyond that of the study site. However, as the e-learning competencies were developed within the context of Learning Management Systems; which have shown to be the primary means by which e-learning is delivered in the university sector (Coates et al., 2005; Siemens, 2006), the e-learning competencies identified in the current study should be of relevance to the broader e-learning community.

The ability of the Hybrid BARS process in the current study to develop a suite of e-learning competencies in accordance with social constructivist principles provided further evidence of the suitability of social constructivism for informing e-learning practice. However, based upon the difficulty and preparedness ratings of the e-learning competencies, students in the current study found learning in e-learning environments developed in accordance with social constructivist principles challenging. Specifically, two issues emerged from the study that were considered to have important implications to the broader e-learning context.

Firstly, based upon responses from the external validation survey, students found balancing work, social, family and study lives in e-learning environments demanding. This finding supports the results of previous studies which have identified similar issues associated with time management. For example, in their study on student attrition, Vergidis and Panagiotakopoulos (2002) found that students' overall underestimation of the time and effort required for effective study and learning was the second most cited reason for discontinuing their studies. The most cited reason being unexpected or emergency situations. Similarly, in a study by Fozdar, Kumar and Kannan (2006), 35% of students cited "lack of time to changing family circumstances" (p. 7) as the reason for their discontinuation.

Although it could be argued that extensive time demands exist irrespective of the nature of the study environment, the necessity to interact and collaborate with others – which are essential activities in e-learning environments built upon social constructivist principles – represents an added dimension that results from the current study suggests students found difficult and not very well prepared to deal with.

Secondly, results from the current study showed that the collaborative construction of knowledge and its associated activities were perceived by students as being difficult. According Bernard, Rojo de Rubalcava and St-Pierre (2000, p. 266), "it is a mistake to assume that learners possess the prerequisites for skilful collaboration". Results from the current study confirm this view. Whether the difficulties experienced in this area by students in the current study were due to a lack of previous experience in general or lack of experience in e-learning environments in particular, was not the major issue. The issue was that students in the e-learning environment examined by this study appeared to be struggling with many of the principles and practices central to social constructivism.

Although results from the current study reaffirmed the suitability of social constructivism for informing e-learning practice, the issues discussed above highlighted a range of problems students encountered in e-learning environments developed in accordance with social constructivist principles. As discussed in the literature review, social constructivism has provided e-learning with a firm pedagogical basis and e-learning has provided a suitable medium for interaction and collaboration (Bauer et al,. 2000). However, perhaps it is in the complementarity between social constructivism and e-learning that the problem lies.

According to Ravert and Evan (2007), e-learning has been embraced as a means of providing social constructivist approaches to learning that have previously been difficult to accomplish. Taking advantage of the affordances of e-learning, lecturers and instructional designers have designed e-learning activities built upon the principles of social constructivism. However, in the process, they have ignored one of the most critical procedures of instructional design – the characteristics and attitudes of the students using these systems (Ravert & Evans, 2007). Critically, students bring with them to the learning process assumptions, motives, intentions, and previous knowledge that determine the quality of the learning that takes place (Biggs, 1996). Failure to take these factors into account is a critical omission and could have important consequences. For as Bell et al. (2002, p. 2) stated, "online learning solutions, which are developed without proper regard to appropriate pedagogies and the needs of students, are destined to failure". So while it appears the e-learning pedagogies may be appropriate, results of the current study suggests that the needs of the students – as evidenced by their perceived lack of preparedness for many of the e-learning competencies – have not being properly regarded. One of the major implications of this situation is that the potential of e-learning environments situated within the social constructivist paradigm may fail to be fully realised. To be effective in a university e-learning environment, students need to be apprenticed into a learning culture of social constructivism. The precursor for effective learning within university e-learning environments is through helping students learn how learning best occurs in these environments.

7.4 IMPLICATIONS FOR THE STUDY SITE

Findings from the present study raised three important implications for the study site: the possibility that student and staff perceptions of e-learning might not be fully aligned with social constructivist principles, the low levels of preparedness of students for what might be considered key 'academic-type' competencies, and student difficulty and low levels of preparedness in the use of the university Learning Management System.

Consistent in the *importance* ratings of the e-learning competencies by both students and staff was the relatively low level of importance placed upon competencies associated with interacting and working with others – competencies considered to be pivotal from a social constructivist perspective. When the competencies were classified according to 'Essential (must have)', 'Important (should have)', and 'Unimportant' criteria, eight of the ten competencies considered as being 'Unimportant' were from the *interaction with the e-learning community* group. Critically, as no significant difference was identified between perceptions of relative *importance* between student and staff stakeholders, the low importance placed upon this group of competencies was consistent across the two stakeholder groups.

Consequently, the view of e-learning held by stakeholders appeared not to be fully aligned with social constructivist principles. This finding supports the view of Jackson (1998), who believed that although constructivism is the dominant espoused theory in higher education it is commonly not the dominant theory-in-use for computer-based learning environments. However, according to Biggs (1996, p. 347), "professionalism requires the espoused theory to be the theory-in-use". The implication for the university is that the espoused theory of social constructivism needs to be the theory-in-use for the delivery of e-learning at the university. As teaching beliefs and practices are largely shaped by the learning theory subscribed to by the educator (Vrasidas, 2000), these beliefs and practices need to be aligned with the principles of social constructivism. The question is how might this be achieved at the study site?

Earlier, it was suggested that students be apprenticed into a learning culture of social constructivism. Correspondingly, staff might need to be apprenticed into a teaching culture of social constructivism. It is sometimes easy to forget that staff are users of e-learning systems as well and, like students, also bring with them assumptions, motives, intentions, and previous knowledge that determine the quality of the teaching they deliver. Critically, few university staff have ever been e-learners (Barnes & Tynan, 2007). To this end, increased attention should be given at the study site to areas such as staff development and instructional design. Like students, staff need to be fully appraised of what learning looks like in e-learning environments built upon social constructivist principles.

The second implication for the study site emerged from the relatively low levels of student preparedness identified for a range of the e-learning competencies associated with interactions with content. A consistent theme running through many of these types of competencies was that they were typically associated with critical thinking skills. Based upon staff perceptions, students were also considered to have a low level of preparedness for a cluster of what might be considered 'academic-type' competencies. These included activities such as: reading and writing, being clear and concise in responses, synthesising ideas, planning strategies, and making an argument.

The critical nature of these types of activities has previously been acknowledged by the university and efforts have been made to help students develop in these areas (e.g., Godwin, 2004; Muldoon & Godwin, 2002). Specifically, programs have been put in place at the university to assist students in a range of areas including study and academic skills such as subject specific writing, academic reading, academic writing, learning strategies, time management (Academic Skills Office, n.d.). Assistance has also been provided in the development of information skills such as searching, selecting, and retrieving information online (Dixson Library, 2009). The inclusion of these types of competencies in the BARS-EL, acts to re-emphasise their importance to e-learning. The low level of preparedness for students as showed by the *preparedness* rankings, reaffirms the need for the continued development of these competencies in students at the university.

Results of the study showed that students were generally considered to have high levels of preparedness for competencies associated with the use of technology and the Internet – for example, using search engines or uploading and downloading resources. The notable exception was the competency associated with the knowledge and use of Learning Management Systems, for which students were ranked lower in preparedness than the other technology competencies.

Finally, the third implication for the study site is that inspection of the support services offered at the university showed that while there were programs in place to train and develop skills in the use of Learning Management Systems for staff (e.g., Teaching and Learning Centre, 2007), there appeared to be no corresponding programs for students.

Although basic computing skills are well supported at the university through programs such as the *International Computers Drivers Licence* (Organisational Development, 2007), formalised support in developing expertise in the university's Learning Management System appears to be absent. Given the relatively low preparedness for students in using Learning Management Systems and the relatively high difficulty rating given to them by the students, some formal training or development program for students in how to use a Learning Management System appears warranted. The need for suitable orientation programs for students beyond the provision of basic computing skills has previously been acknowledged in the literature (Cheurprakobkit et al., 2002). The relatively low level of student preparedness in using Learning Management Systems identified by the current study reaffirms the need for continued attention in this area.

7.5 IMPLICATIONS FOR THE HYBRID BARS METHODOLOGY

Findings from the study identified two important issues that have future implications for the use of Hybrid BARS. These were the independence of the performance dimensions and the identification of the performance dimensions and competencies.

7.5.1 Independence of the performance dimensions

The assumption of Hybrid BARS that performance dimensions identified be conceptually distinct and independent remains problematic. As in Dickson's (2000) study, the independence of performance dimensions structure in the current study could not be empirically validated. For the e-learning competencies identified using the Hybrid BARS process, it was demonstrated using factor analysis on the *importance* data set, that alternate groupings of the competencies were possible. However, this was a qualified finding due to the size of the study sample as the 16 performance dimensions could not be analysed as a complete set but rather as four equal-sized sets. Further examination using Rasch analysis on the *importance* data set showed the e-learning competencies to be unidimensional and measuring a single underlying construct. In his study on soccer refereeing for example, Dickson (2000) also found that competencies developed using the Hybrid BARS process were unidimensional.

The importance of unidimensionality has been acknowledged in the literature with respect to factor analysis (Blaikie, 2003). However, its importance to the Hybrid BARS process should be emphasised as well. Results from both the study by Dickson (2000) and the current study have shown the Hybrid BARS process to be a valid means of identifying sets of competencies that are unidimensional and therefore measuring a single underlying construct. Thus, there is a reasonable level of confidence that competencies developed by the Hybrid BARS process are an accurate and valid reflection of the role under review. In other words, competencies developed using Hybrid BARS have a high degree of internal validity. However, competencies that measure a single underlying construct are incompatible with the notion of independent performance dimensions. This is because different groupings of the competencies beyond that defined by the performance dimensions are possible (Dickson, 2000).

As was the case for Dickson's (2000) study, analysis of the competencies in the current study was able to proceed independently of the performance dimension framework. This suggested that the identification of performance dimension might be able to be dispensed with in the Hybrid BARS process. However, the discussion that follows presents a case for the continued use of performance dimensions irrespective of whether their independence can be substantiated by empirical means.

7.5.2 Identification of performance dimensions and competencies

Dickson (2000) believed the standard Hybrid BARS practice of developing competencies first and then grouping them into performance dimensions was valuable as it helped support further exploration of the data and facilitated subsequent discussion of the results. This was because the performance dimension structure provided a useful organising framework for the competencies. Dickson's conclusion was supported by the current study. Analysis of the importance ratings of the performance dimensions was able to provide both a useful overview of stakeholders' views and an early indication that the e-learning competencies of the BARS-EL were not of equal status. However, Dickson's conclusion was based on having performance dimensions that had been developed *after* the competencies had been identified. Evidence from the current study suggested that developing performance dimensions *before* the competencies, as originally proposed by Smith and Kendall (1963), also aided in the identification of competencies and facilitated in their subsequent analysis.

As described in Chapter Four, the first session of the expert panel workshop involved the development of the performance dimensions for e-learning. For both workshops, panel members used more than the scheduled time allotted for the development of the performance dimensions. However, less time was required to identify the e-learning competencies. This was because subsequent discussions were more focused, as expert panel members were able to develop competencies within the context of the previously defined performance dimension framework. Consequently, three activities that were originally allocated as three sessions in the expert panel workshops and used in previous Hybrid BARS studies: identification of action words and phrases, combination of action words and phrases, and development of competencies from action words and phrases, were not required. This was because panel members found the generation of intermediary action words or phrases unnecessary as they were able to generate the competencies directly using the already defined performance dimension framework.

For original BARS, the motivation for the modifications to Smith and Kendall’s (1963) methodology was to shift the focus away from the performance dimensions by developing the competencies first and then subsequently grouping them into performance dimensions (Campbell et. al., 1973; Schneier & Beatty, 1979). However, the current study demonstrated the advantages of incorporating Smith and Kendall’s original design into the Hybrid BARS methodology. Doing so streamlined the competency development process and removed the need to define action words and phrases as the performance dimensions already provided a suitable contextual framework within which the competencies could be developed.

7.6 RECOMMENDATIONS FOR FURTHER RESEARCH

The findings of the current study raised four issues considered to be worthy of further investigation. Each is presented below.

7.6.1 Independence of the performance dimensions

Doubt still remains as to whether independent performance dimensions can be developed using the Hybrid BARS process. The first of two recommendations made by Dickson (2000) was investigated by the current study. In this instance, performance dimensions were developed first and then competencies were generated aligned with these performance dimensions. The study found that the independence of the performance dimensions developed in this manner could not be validated empirically using factor analysis. However, due to the small sample size of the current study (n = 35), the complete set of performance dimensions could not be analysed using factor analysis. A future study with a larger sample size, in which the complete set of performance dimensions could be analysed using factor analysis, would allow for more conclusive findings to be drawn about performance dimension independence.

Dickson's second recommendation – the development of competencies independently and their subsequent grouping into performance dimensions based upon the results of factor analysis or Rasch analysis – remains untested. As in Dickson's (2000) study, the current study showed both factor analysis and Rasch analysis to be effective means of confirming performance dimension structure. However, the degree to which either method could be used to effectively group competencies in a conceptually meaningful way still needs to be determined by further research. Future studies might also be able to provide the necessary evidence to make a definitive conclusion about the independence of performance dimensions developed using the Hybrid BARS process.

7.6.2 Application of the BARS-EL to a broader context

The relative *importance*, *difficulty* and *preparedness* of the e-learning competencies were assessed by e-learning stakeholders at the one institution, however broader assessment of the BARS-EL beyond the study site is required to determine the external validity of the e-learning competencies identified in the current study. This is to ensure that other factors that might have been unique to the study site did not influence stakeholders' perceptions of importance, difficulty and preparedness of the e-learning competencies.

Assessment of the *importance*, *difficulty* and *preparedness* perspectives were also shown to be a useful means of identifying differences in perceptions between stakeholder groups. A study that surveys stakeholders across a number of institutions is recommended to determine whether differences in perceptions also exist between students and staff of other institutions; as was the case for the current study. Broader application of the BARS-EL beyond the study site would also allow for a range of comparative studies to be conducted.

7.6.3 Re-application of the BARS-EL to the current context

It is recommended that stakeholders at the study site be re-surveyed to determine whether perceptions of importance, difficulty and preparedness of the e-learning competencies have changed since the implementation of the external validation survey. One of the findings of the current study was that both student and staff stakeholders had a view of e-learning that was not fully consistent with the principles of social constructivism. However, the extent to which this view currently persists amongst students and staff at the study site is not known. It is recommended that a formal, university-wide survey of students and staff using the survey instrument developed for the current study be implemented to clarify this issue.

Re-application of the survey would also help determine whether differences still exist between students and staff perceptions of the difficulty and preparedness of the e-learning competencies. Additionally, the extent to which possible differences in perceptions are aligned with particular disciplines, faculties, level of study, gender, age level of students, at the institution still remains to be explored.

7.6.4 Development of the BARS-EL as an instrument to assess self-efficacy

There is scope for the e-learning competencies of the BARS-EL to be developed into an instrument measuring e-learning self-efficacy. Self efficacy is associated with the beliefs an individual has about their capabilities to successfully perform a particular task (Cassidy & Eachus, 2002). Self-efficacy has been shown to be important in determining whether or not tasks are initiated, the amount of effort expended on a task, and the degree of persistence in a task (Bandura, 1977). Consequently, the creation of an e-learning self-efficacy instrument would be a useful diagnostic tool to assess student capabilities and readiness for performing in university e-learning environments.

A number of instruments have been created previously to assess both computer self efficacy and Internet self efficacy. For example, the *Computer Self Efficacy Scale* (Cassidy & Eachus (2002), and the *Internet Self Efficacy Scale* (Eastin & LaRose, 2006). However, a brief survey of the literature suggests that e-learning self-efficacy scales are not common. One scale identified – the *E-Learning Self Efficacy Scale* (Mungania & Reio, 2005), was simply a modified and synthesised version of the computer and Internet self-efficacy scales identified above. A more recent scale, the Learning Management System Self Efficacy Survey (LMSES) was developed by Martin and Tutty (2008). One of the main limitations of this scale is that it restricts the assessment of student self-efficacy to operational tasks associated with using Learning Management Systems, such as replying to messages, initiating a chat session, and posting reflections in a blog. Critically, the LMSES focuses on these tasks at the expense of more complex learning activities that take place within Learning Management Systems such as those activities captured by the competencies in the BARS-EL. Therefore, the creation of an e-learning self-efficacy scale using the e-learning competencies of the BARS-EL is recommended. Such a scale, once developed, would need to be validated by demonstrating that high levels of perceived student e-learning self-efficacy were correlated with high levels of student achievement in e-learning environments. Construction of a self-efficacy scale based upon the BARS-EL would lead to a better understanding of e-learning, particularly within the context of Learning Management Systems.

7.7 CONCLUSION

The aim of the current study was to identify the competencies required for effective performance in a university e-learning environment. Using a procedure known as Hybrid BARS, 58 competencies were identified which were considered to be essential for effective performance in a university e-learning environment set within the context of a Learning Management System and situated within the social constructivist learning paradigm.

The e-learning competencies identified in the current study described in observable and measurable terms the requisite knowledge, understandings, skills, attitudes and behaviours students required for effective performance in a university e-learning environment. By describing the e-learning competencies in this manner, a problem common to previous research into e-learning competencies – the tendency to focus on traits and characteristics – was avoided.

The subsequent assessment by student and staff stakeholders of the relative *importance*, *difficulty* and *preparedness* of the e-learning competencies provided unique insights into the area of e-learning competencies that have been previously unexplored in the literature. In particular, the study showed that the e-learning competencies were not of equal status. Consequently, the e-learning competencies could be ranked according their perceived levels of importance, difficulty and preparedness. A further finding was that while student and staff stakeholders held similar perceptions of the relative *importance* of the e-learning competencies, their perceptions of relative *difficulty* and *preparedness* were significantly different.

Critically, results from the current study reinforce the importance of designers and deliverers of university e-learning environments taking into account the needs of learners. Failure to do so could mean that the affordances offered by both e-learning and social constructivism might never be fully realised.