Chapter 4

Findings:
Factors to promote quality web-supported learning

4.1 Overview of this chapter

This chapter presents the findings for the first research question of this study:

What factors[1] promote quality web-supported learning?

The method and procedures for this research question were presented in chapter 3, section 3.4.3. The primary strategy was the literature review which identified and analysed studies of two types: those which present classic benchmarks, indicators and principles for quality web-supported learning (section 2.5.1), and those that identify criteria for exemplary or promising courses (section 2.5.2). That comparative analysis produced a taxonomy of factors which contribute to the quality of web-supported learning (Table 2.3). Details of the studies reviewed in chapter 2 are given in Appendix C (Tables C2 to C6).

Since the taxonomy was synthesized, additional studies[2] on quality issues relating to instructional technologies emerged, both from database searches and from the bibliographies of other papers. In this chapter, these additional studies are reported in as far as their findings corroborate or extend the taxonomy. Some of the more applicable studies are reported in detail (section 4.2), but since this chapter is not a literature review, most are listed in Appendix C (Table C11), together with the factors that they identified.

[1] The word 'factor' is used throughout in the ordinary everyday sense of the word, such as 'characteristic' or 'aspect'. No statistical *factor analysis* is implied or intended.
[2] The dates were confined to those published since 2000.

The updated and extended taxonomy is presented in section 4.3 (Table 4.2). Critical colleagues within the case study were asked to reflect on and refine the taxonomy for purposes of triangulation and verification. The refined taxonomy, which answers this research question, is given in Tables 4.3 and 4.4. In order to provide a visual synthesis and interpretation of the taxonomy, it is mapped onto Ingwersen's (1996) cognitive model of information retrieval (IR) interaction (Figure 4.3).

4.2 Corroboration by recent publications

After the initial literature review was completed, new studies emerged from database searches, as well as from other sources. These are analysed in this section to corroborate and extend the findings of the taxonomy of factors to promote quality web-supported learning[3].

4.2.1 The Sloan-C framework

The Sloan Consortium (Sloan-C) is a consortium of accredited higher education providers that "encourages collaboration, sharing of knowledge and effective practice to improve online education in the areas of learning effectiveness, access, affordability for learners and providers and student and faculty satisfaction" (Lorenzo & Moore, 2002, online reference).

At a workshop held in Lake George, New York in September 2002, editors led discussion sessions on the Five Pillars for Quality Online Education:

- learning effectiveness;
- cost effectiveness;
- access;
- faculty satisfaction;
- student satisfaction.

[3] The terminology used (e.g. "online learning", "web-based learning") reflects that used by the respective authors.

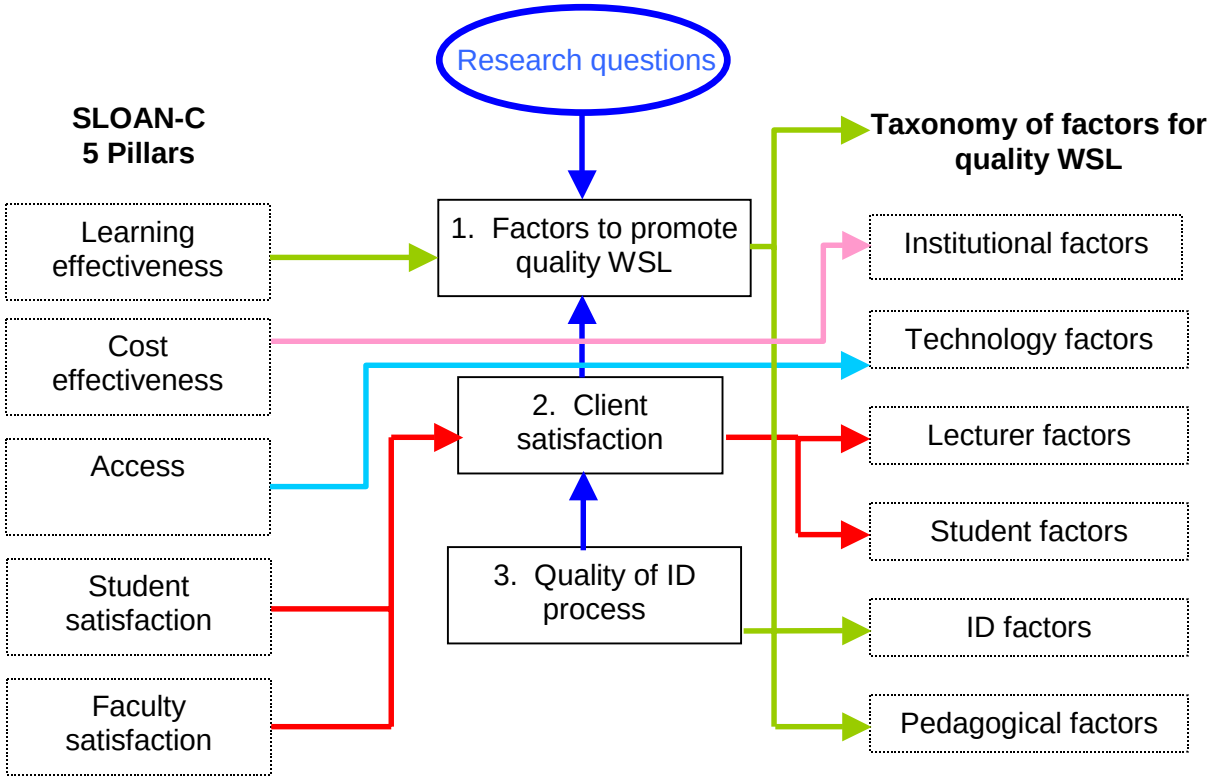
More details of the elements within the five pillars are given in Appendix C, Table C9.

The Sloan-C report to the nation (Lorenzo & Moore, 2002) highlights the following factors that contribute to the *learning effectiveness* pillar in the online environment:

- interaction with classmates, instructors and content;
- online learning environments that generate meaningful discourse and encourage deep reflection;
- significant opportunities for collaboration between student and faculty and student and student.

> Sloan-C's five pillars are a framework for measuring and improving an online program within any institution. Quality in online education is often thought to mean 'learning effectiveness', and that is certainly one element, and is one of the pillars. However, learning effectiveness has greater meaning when it is combined within a framework that encompasses all five pillars. (Lorenzo & Moore, 2002, p.3)

Two of the Sloan-C pillars (*student and lecturer satisfaction*) directly reflect research question 2 in this study (client satisfaction). The pillar of *learning effectiveness* is reflected particularly in the categories of instructional design and pedagogical factors in the taxonomy of factors for quality web-supported learning synthesized in this study (Table 2.3). The pillar of *access* and related issues corresponds to the category of technology factors in the taxonomy. Figure 4.1 shows the links between the Sloan-C framework and the taxonomy.



Key: ID = "instructional design"; WSL = "web-supported learning"

Figure 4.1: Mapping between Sloan-C framework, the research questions and the taxonomy of factors for quality web-supported learning

Parallels can be seen between four of the Sloan-C pillars and the taxonomy of factors for quality web-supported learning synthesized in this study:

- Learning effectiveness is reflected by the whole taxonomy, in particular *instructional design* and *pedagogical* factors.
- Access is directly addressed by several items in the category: *technology* factors.
- Student and lecturer satisfaction, both addressing the question of client satisfaction with web-supported learning, are the essence of research question 2 in this study. The same clients are reflected in the categories of *student* and *lecturer* factors respectively.

One of the Sloan-C pillars, *cost effectiveness*, maps onto institutional factors, but is not analysed further in the taxonomy. The reason is that the unit of analysis and the research questions in this study focus on process and product issues, rather than cost issues. Furthermore, this case study is built

on an existing infrastructure, in which a campus-wide learning management system and human and technology resources are already in place, so no cost estimates for establishing such facilities and services had to be compared. Scope for further research is to investigate the extent of the University's return on investment, in the sense of the impact of TLEI as a support unit serving the University.

4.2.2 Methodological framework for online teaching and learning

Zhao (2003) alludes to enticing issues in his abstract:

> Drawing on the current principal literature, this study explores a range of issues affecting the quality of online higher education; examines a variety of perspectives on criteria for quality online teaching and learning; and proposes a methodological framework for the measurement of both the process and outcomes of online teaching and learning. (p. 214)

He advocates a holistic approach to evaluating the quality of online learning (as does this study). He identifies three categories for investigation: information technology, pedagogy and administration, which are congruent with the categories technology issues, pedagogical principles and institutional factors in the taxonomy in this study.

Zhao (2003) refers to the literature and identifies additional criteria in terms of the quality of online courses:

- extent of platform and browser compatibility;
- extent of synchronous communication;
- extent of asynchronous communication;
- ease of creation and maintenance of course material;
- extent of online help including how-to-use tutorials;
- extent of online assessment activities;
- fostering collaborative work;

- extent of customisation;
- effectiveness of results management and flexibility of report generation;
- interaction, which increases student satisfaction ;
- a responsive instructor.

Zhao's (2003) paper makes several suggestions of what *might* be done, for example, using the standard *Servqual* service quality instrument to measure academic (lecturer) satisfaction. The methodological framework is a theoretical discussion of the following "four crucial building blocks" (p. 218):

1. **Course effectiveness**: this includes the curricula and learning resources which should be up to date, relevant, comprehensive and culturally sensitive.
2. **Adequacy of access** in terms of technology infrastructure: technology needs to be accessible, reliable, fast and easy to use. This includes technical support services for students and instructors and student training.
3. **Student satisfaction**: asynchronous and synchronous interactions between instructors and students, timely feedback and mentor support.
4. **Academic (lecturer) satisfaction**: opportunities for quality interaction with students, for leadership, research and professional development. This includes ongoing staff training and development in ICTs.

As can be seen from the list above, Zhao's (2003) work leans heavily on the five pillars of the Sloan-C consortium, which he references. Both Sloan-C and Zhao state that their work is based on extensive literature reviews, and some recommendations are clearly from Chickering & Gamson (1987), such as the importance of student-student and student-faculty interaction.

4.2.3 Pedagogical framework

Herrington, Herrington, Oliver, Stoney and Willis (2001) developed a framework summarizing what they consider to be critical elements of effective online learning environments. Their intention was to "describe a workable set of guidelines for academic and support staff in the development and benchmarking of online course quality" (Herrington et al, 2001, p. 263). They express the hope that their guidelines will be useful in assessing the quality of existing online courses as well as online courses in development.

These authors organised their framework according to the following categories:

- Quality of Pedagogy;
- Quality of Resources;
- Quality of Delivery Strategies.

The Pedagogy category emphasizes meaningful assessment, engagement of learners and opportunities for collaboration. The Resources category recommends guidelines for high quality learning materials and resources, such as accessibility, currency, richness and inclusivity. The Delivery Strategies category concentrates on the reliability of the interface, bandwidth and download demands, as well as communication between students and lecturers. The full framework is summarised in Appendix C (Table C7).

This framework is currently being implemented with instructional designers and faculty at Edith Cowan University. The iterative process will result in modifications and improvements to the instrument which can be thought of as summative evaluation of the framework.

4.2.4 Importance of the Institute for Higher Education Policy study (2000)

One of the primary source documents that contributed to the taxonomy is the *Quality on the Line* study, which presented 24 benchmarks for quality online

teaching and learning (Institute for Higher Education Policy (IHEP), 2000 - see Appendix C, Table C2).

The third Pew symposium on preserving quality in distributed learning environments analysed the IHEP study in detail (Twigg, 2001). The symposium preferred the term *distributed learning* to *distance learning*, since it dispels myths about specific preconceptions about distance learning and emphasizes the combination of both on- and off-campus online teaching and learning.

Twigg (2001) confirms that the IHEP study is particularly useful because:

> … it appears to encompass all of the previous efforts and because knowledgeable, experienced practitioners – those with concrete experience as to what works well and what does not in distributed learning environments – have vetted the benchmarks. Moreover, as part of the preparation for the symposium, we asked the participants to make their own list of key quality indicators. Practically all of their responses duplicate the IHEP benchmark list. (Twigg, 2001, p. 7)

The above comment is a powerful corroboration of the extent and reliability of the IHEP study, which contributed substantially to the taxonomy.

Yeung (2002) investigated critical success factors to contribute to quality assurance of web-based learning in Hong Kong. His paper is also based on the IHEP study mentioned above (Institute for Higher Education Policy, 2000). Yeung (2002) used a questionnaire to measure the perception of academic staff as to a) whether the IHEP benchmarks are important to ensure quality and b) whether they were present at the time in the University of Hong Kong. A final item asked the academic staff to list important quality benchmarks that are not present in the IHEP study. The findings from the latter item yielded the factors listed in Table 4.1.

Table 4.1:

Additional quality indicators listed by academic staff (from Yeung, 2002)

attractiveness	accuracy	capacity
consistency	creativeness	flexibility
feasibility	fun	informative
interesting	interaction	innovation
motivation	popularity	reliability
rich content	stability	technical support
user friendliness		

Most of the above factors are in the taxonomy (e.g. *interaction*, *motivation*, *reliability*, *technical support*). Others such as *user friendliness* are an intrinsic part of sound instructional design practice (see Table 4.2 and its antecedent assumptions).

In South Africa, Herman (2001) and Bezuidenhout (2004) conducted studies also based on the IHEP study, at the University of Stellenbosch and the Central University of Technology (formerly Free State Technikon) respectively.

4.2.5 Brief overview of the findings of other studies

Many studies since 2000 have focused on the issue of quality in web-supported teaching and learning, because of its prevalence and topicality. Additional relevant studies are reviewed in Appendix C (Table C11) in as far as they support or extend the factors in the taxonomy.

There are undoubtedly many more studies that engage with various aspects of assessing and improving the quality of web-supported courses. Some of the studies reviewed in Table C11 focus only on student feedback, others focus only on one particular (small) course, while others focus only on pedagogical aspects of online learning. The taxonomy in this study is an attempt to present a holistic view of categories and factors to be considered in promoting the quality of web-supported courses.

The next section takes the taxonomy which emerged from the comparative analysis in chapter 2 (Table 2.3), extends it by incorporating findings from other studies reviewed in Appendix C (Table C11), and re-organises the layout and phrasing, so as to make it easier to apply in practice.

4.3 Extension and re-organisation of the taxonomy

The categories on which the taxonomy is based are institutional, technology, lecturer, student, instructional design and pedagogical factors. This categorisation is maintained in this chapter.

Miles and Huberman (1994) promote the use of data displays such as matrices, charts and networks, as a major avenue to valid analysis of textual data. They claim that "valid analysis requires, and is driven by, displays that are focused enough to permit a viewing of a full data set in the same location, and are arranged systematically to answer the research questions at hand" (p. 91). Data displays in the form of tables and graphics are used in this chapter in order to assemble organised information into an immediately accessible, compact form, making the data more accessible to the researcher and reader alike.

According to Miles & Huberman (1994), the first step in data analysis is data reduction. The original taxonomy used synonymous words or phrases to clarify the nuances in various factors, so as to be able to classify items from the source studies. Table 4.2 is a reduction of the wording of items in the taxonomy, focusing on single words or phrases to list the factors in each category[4].

Additional relevant studies published since 2000 were identified and reviewed in Appendix C (Table C11). Most of these studies corroborated factors

[4] If not stated, adjectives such as 'effective', 'appropriate', 'optimal' are implied in the reduced list.

already in the taxonomy. Ten additional factors that were not already in the taxonomy were identified from Table C11:

- community and empathy (Waddel & Byrne, 2003) *[lecturer]*;
- layout and presentation (Herrington et al., 2001) *[instructional design]*;
- appropriate bandwidth and download demands (Herrington et al., 2001) *[technology]*;
- learner-centered environment (Herrington et al., 2001) *[pedagogical]*;
- currency of learning resources and content (Applebee, Dearn, Donnan, & Kiley, 2003; Herrington et al., 2001) *[pedagogical]*;
- usability (Alley, 2000; Foreman, Nyatanga & Rich, 2002) *[instructional design]*;
- multiple learning paths (Alley, 2000) *[pedagogical]*;
- reusable learning objects (Oliver, 2001) *[instructional design]*;
- reusable learning designs (Oliver, 2001) *[instructional design]*;
- student selection and entry into courses (Oliver, 2003) *[institutional].*

The suggested categories for inclusion in the taxonomy are given in brackets. The above factors are now added into the reduced taxonomy (Table 4.2). The ten additional factors are indicated in (blue) italic text. In Table 4.2 the categories are represented two-by-two in adjacent columns. This assists in reducing and synthesizing the factors.

Table 4.2: *Expanded taxonomy*

Institutional factors	Technology factors
Technology plan	Appropriate use
Infrastructure	Reliability
Student consultation	Accessibility
Institutional programme evaluation	IT support and training for lecturers
Organisational change	IT support and training for students
Student selection and entry into courses	*Appropriate bandwidth and download demands*
	Management of student data
Lecturer factors	**Student factors**
Interaction with students	Communication
Feedback to students	Time management
Professional training	Self directed learning
Evaluation of teaching competence	Client expectations
Academic background	Critical thinking
Community and empathy	Motivation
	Problem solving
	Client satisfaction
Instructional design factors	**Pedagogical factors**
Group learning	Learning outcomes
Engagement	High expectations
Higher cognitive levels	Assessment strategies
Learning resources	Diversity
Learning materials	Clearly stated expectations
Interactivity	Self reflection
Standards	Non-threatening environment
Course evaluation	Research methodology
Inclusivity	Relevance of content
Student motivation	Accuracy of content
Modular chunks	*Currency of content and learning resources*
Use of media	Continuous improvement
Use of images, graphics, animation	Educationally significant goals
Complete learning package	Adaptable, sustainable, scaleable
Layout and presentation	*Learner-centered environment*
Usability	*Multiple learning pathways*
Reusable learning objects	
Reusable learning designs	

Table 4.2 reflects the first attempt to answer research question 1, by listing factors in six categories, to promote the quality of web-supported learning. The taxonomy was refined and corroborated by critical colleagues in two case

analysis meetings, as described below.

The critical colleagues confirmed the importance of all the factors listed in Table 4.2. Various suggestions were made in terms of rewording, merging and adding to the list of factors, based on the experience of the critical colleagues in this case study. These modifications are discussed below the resulting "combed" taxonomy (Table 4.4).

In synthesizing such a taxonomy, it is impossible to list *all* critical success factors for quality web-supported learning. It is inevitable that other researchers will suggest additional factors. In attempting to be as comprehensive yet as succinct as possible, earlier research resulted in listing two types of basic factors separately (Fresen & Boyd, 2003):

- basic *assumptions* which must be in place before quality web-supported learning can even be contemplated;
- *exogenous* (external) factors, which are important for quality web-supported learning, yet are beyond the control of e-learning practitioners.

The critical colleagues agreed with listing underlying assumptions and exogenous factors separately. These factors are listed in Table 4.3, reflecting the suggestions and consensus of the critical colleagues. The resulting refined taxonomy of critical success factors for quality web-supported learning is presented in Table 4.4.

Table 4.3

Underlying assumptions and exogenous factors forming the foundation of the taxonomy

Underlying assumptions	Exogenous factors
• ICT infrastructure; • information literacy of clients; • basic computer literacy of clients; • positive attitude of lecturers; • commitment and motivation of clients; • sound advice, support and consultation to lecturers with respect to instructional design and educational practice; • sound instructional design practice; • sound teaching and learning practice; • commitment to continuous improvement.	• quality of the institutional learning management system[5]; • stability of national telecommunications infrastructure; • class size; • work load of clients; • recognition and incentives for lecturers.

The refined taxonomy presented in Table 4.4 should be read with the understanding that the underlying assumptions listed above are taken as given and that the exogenous factors are acknowledged.

[5] See section 1.9.1: *Constraints of this study*.

Table 4.4

Resulting taxonomy of factors to promote quality web-supported learning[6]

Institutional factors	Technology factors
Technology plan	Appropriate use of technology
Student selection and entry into courses	Reliability
Student consultation	Availability
Institutional programme evaluation	System training for clients
Change management	IT support for clients
Standardisation of information design and dissemination	Appropriate bandwidth and download demands
	Management of student data
Lecturer factors	**Student factors**
Interaction / facilitation	Communication
Frequent feedback	Time management
Academic background	Self directed learning
Evaluation of teaching competence	Critical thinking
Community and empathy	Problem solving
Instructional design factors	**Pedagogical factors**
Usability: • Modular chunks • Use of media • Use of images, graphics, animation • Layout and presentation • Standards • Accessibility **Learning principles:** • Collaborative learning • Interactivity • Engagement • High expectations • Higher cognitive levels	Learning outcomes, goals, expectations Flexible learning package Assessment strategies Learning styles Learner-centered learning environment Content and learning resources: relevance, accuracy, currency Adaptable, sustainable, scaleable, reusable Self reflection

Various new factors were suggested by the critical colleagues, for example the importance of standardised dissemination of information, on an institution-wide basis. This factor refers to the importance of standardising the *information design* of all applications that influence web-supported learning, for example the user interface of campus portals, access to library reference pages etc. Another suggestion was to subdivide the instructional design factors into two subsections, *usability* and *learning principles*.

[6] (to be read in conjunction with Table 4.3)

Further modifications agreed upon were that the term *inclusivity* should be re-worded as *accessibility* and moved to *technology* factors. The current connotation of the word *accessibility* is access to technology for persons with disabilities, both learning and physical disabilities (Brown, 2004). Similarly *diversity* was reworded as *learning styles*, which is intended to include equity issues as well as social, cultural and gender sensitivity. The term *organisational change* was replaced with *change management*, a term more widely used in the field of education innovation.

4.4 Answer to research question 1

One of the critical colleagues suggested that the taxonomy in Table 4.4 could be meaningfully mapped onto Ingwersen's (1996) cognitive model of information retrieval (IR) interaction. The benefit of such a mapping is that it provides a practical and holistic interpretation of the complex issues involved in synthesizing factors to promote quality web-supported learning.

Ingwersen's model is presented in a simplified form in Figure 4.2 and discussed below the figure. The graphic version of the mapping of the categories in the taxonomy (Table 4.4) onto Ingwersen's model is given in Figure 4.3.

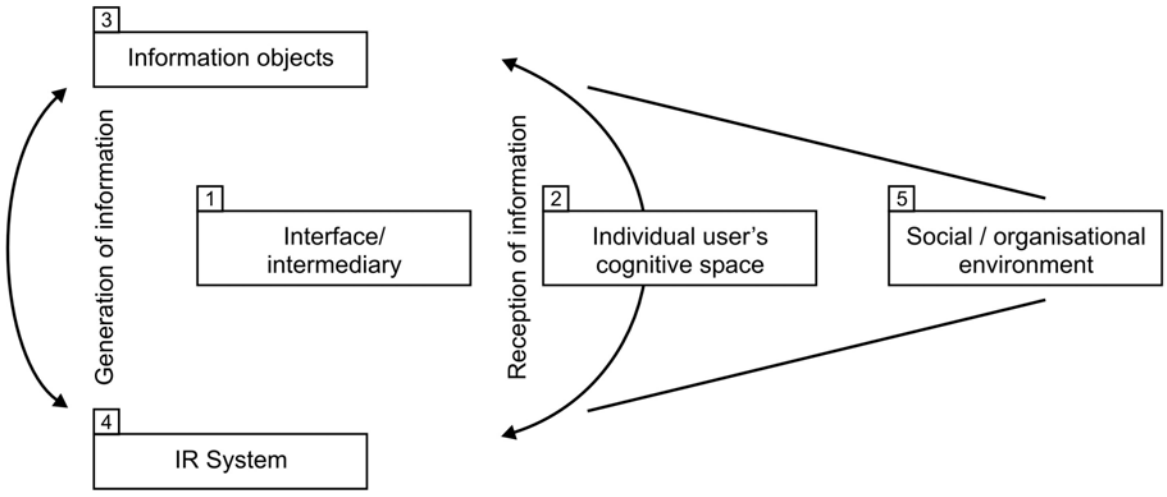


Figure 4.2: Simplification of Ingwersen's (1996) cognitive model of IR interaction.

The details of Ingwersen's model, such as particular items in each section and the flow of transformation, influence, interaction and communication between items are excluded from Figure 4.2, in order to simplify the concepts and to enable a mapping with the taxonomy.

The following discussion takes Ingwersen's model as a point of departure and interprets it in respect of the taxonomy of factors for quality web-supported learning presented in this chapter.

In Figure 4.2, the interface, or intermediary (1) may be human or a computer. In the context of this study, it would be the computer providing access to web-supported courses (this maps onto *technology factors* in the taxonomy). The individual user (2) is the client, namely the student or lecturer participating in web-supported teaching and learning situations (this maps onto the *lecturer* and *student factors*). The information objects (3) are the web-supported learning products that the student is engaging with, including content, resources, learning activities etc. These learning opportunities are based on the *instructional design and pedagogical factors* that need to be considered in designing and developing quality web-supported learning products. The information retrieval system (4) is the *institutional infrastructure* to enable either information retrieval or in this case, web-supported-learning. The social or organizational environment (5) includes institutional and exogenous factors, as well as the underlying assumptions that are required for quality web-supported learning. For example, underlying assumptions such as positive attitudes, motivation, class size and incentives for lecturers are part of the social and organisational environment.

Figure 4.3 presents the taxonomy for quality web-supported learning mapped onto Ingwersen's (1996) cognitive model for IR, as interpreted in the foregoing discussion.

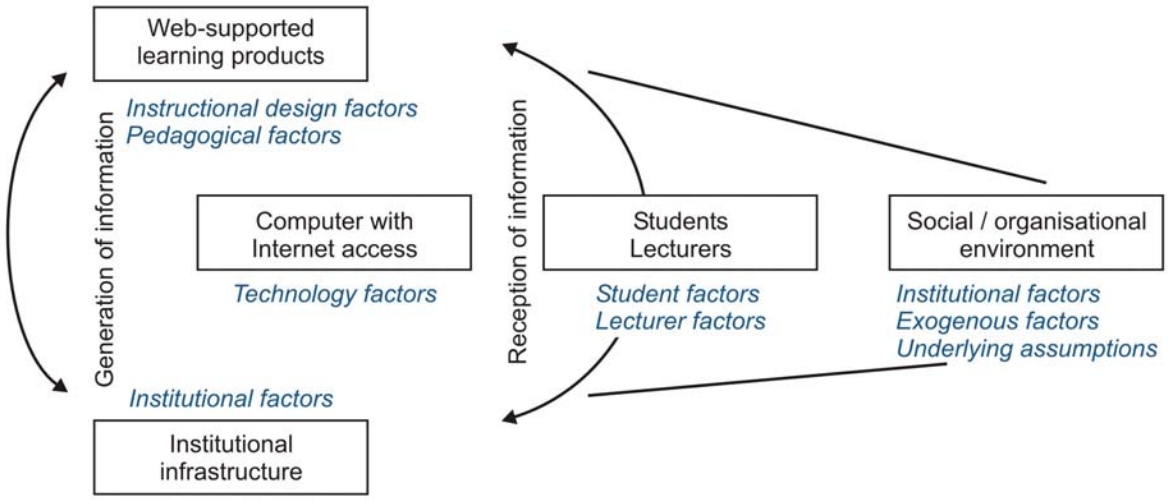


Figure 4.3

Graphic interpretation of the taxonomy for quality web-supported learning, mapped onto Ingwersen's (1996) cognitive model of IR

In Figure 4.3, the categories of the taxonomy are indicated in (blue) italic text. *Institutional factors* appear twice, since they appear to map naturally onto both the *institutional infrastructure* and onto the *organisational environment*.

The graphic interpretation of the taxonomy (Figure 4.3) can be considered compatible with other cognitive, graphic representations relevant to this study. Examples of such compatible representations are:

- the conceptual framework in this study (Figures 2.5 and 7.1);
- the *rich pictures* of Checkland (1999) which attempt to represent complex systems and interactions;
- the TLEI relationship diagram used in the quality assurance training workshops in this case study (Boyd, 2001b).

The latter diagram is not included in this thesis, but it interprets the position of TLEI as a support department within a complex system of interactions and interrelationships with academic departments.

The answer to the first research question is therefore given by the ***taxonomy of factors for quality web-supported learning***, which has three

components:

- underlying assumptions and exogenous factors (Table 4.3);
- refined taxonomy of factors, in six categories (Table 4.4);
- graphic interpretation providing a cognitive summary (Figure 4.3).

4.5 Summary

This chapter presents the findings for the first research question, which searched for factors to promote quality web-supported learning.

The literature review in chapter 2 produced a taxonomy of factors to promote quality web-supported learning, in six categories: institutional, technology, lecturer, student, instructional design and pedagogical factors (Table 2.3). Subsequent to that analysis, additional studies (limited to those published from 2000 onwards) were identified from data base searches and other sources. Undoubtedly there are more such studies, but few appear to present a holistic approach to quality in web-supported learning, by applying standard quality assurance practice to products, process and client satisfaction measures.

The additional studies reviewed (see Appendix C, Table C11) corroborated many of the factors in the taxonomy and yielded ten additional factors including amongst others, usability, currency of content and resources, re-usability of learning objects and technical issues such as appropriate bandwidth and download demands. The taxonomy was combed and refined with the assistance of critical colleagues within the case study (Table 4.4).

It emerged from earlier research (Fresen & Boyd, 2003) that there are certain fundamental underlying assumptions that need to be in place before quality web-supported learning may be realised at all. There are also exogenous (external) factors, such as class size and remuneration for lecturers, that are important in enhancing the quality of web-supported learning, yet are beyond the control of e-learning practitioners. These underlying assumptions and

exogenous factors (Table 4.3) are part of the answer to this research question and should be read in conjunction with the refined taxonomy (Table 4.4).

In order to present a practical, holistic graphic interpretation of the taxonomy of factors, the categories in the taxonomy were mapped onto Ingwersen's (1996) cognitive model of IR interaction (Figure 4.3). Thus the answer to research question 1 is in three parts: the underlying assumptions and exogenous factors to be considered (Table 4.3), the taxonomy of factors in six categories (Table 4.4), and the graphic interpretation of the taxonomy (Figure 4.2).

The web medium offers increased convenience and alternative methods of communication and assessment. There are changing roles for both lecturers and students in learning how to make optimum use of electronic media. Issues such as change management, accessibility, learner-centered environments and technology access and reliability have an impact on the quality of web-supported learning products. The taxonomy presented in this chapter is an attempt to provide a holistic theoretical basis from which to pursue excellence in web-supported learning.

An opportunity for further research is to test the taxonomy of factors for quality web-supported learning empirically. Instructional designers and project managers need to modify the categories and factors proposed to assure quality in the learning experiences they design and implement in their own particular situations.