Chapter 3

Research Design and Methodology

3.1 Overview of this chapter

This chapter presents the research philosophy, design and methodology for this study. The research philosophy is presented first, in order to clarify the researcher's epistemological viewpoint. The research design presents the design choices made and the strategies that were used to answer the research questions. Thereafter the methodology is described in terms of the sampling and participants, instruments, procedures, data collection and data analysis.

3.2 Research Philosophy

The philosophical foundation of this study has grown and evolved from a predominantly positivist epistemology towards a more naturalistic, interpretive epistemology. This viewpoint implies:

- focusing on trying to understand and interpret a particular phenomenon (i.e. *quality in web-supported learning*);
- being directly and personally involved in the research project;
- investigating the 'taken-for-granted' (constructs such as *quality*, *systems* and *evaluation*);
- having a concern for individuals involved (e-learning practitioners and clients) – this is described as *existential phenomenology* (Schutz, as described by Cohen, Manion & Morrison, 2000);
- having a practical interest in the case study, in order to continuously improve real world practice.

The philosophy described above is in line with Creswell's (2003) *pragmatic, mixed methods* approach, in which there is a concern with applications and

solutions to problems. This study makes use of *qualitative* methods, such as case analysis meetings (Miles & Huberman, 1994), interviews with lecturers ("guided conversations", Yin (2003a) p. 89) and task teaming (Vinca, 2004). Section 3.4.3: *Procedures* gives details of the procedures involved for these data collection methods. This study also has a *quantitative* component in the form of statistical analysis of closed questions in the student survey (see section 3.4.5: *Data analysis*).

In keeping with the exploratory nature of this study and the mixed methods approach, a combination of etic and emic data was gathered: etic data from the surveys and emic data from the case analysis meetings, interviews and task teams (see Table 3.1: *Research strategies*).

3.3 Research Design

This section presents the research design for this study, followed by the research methodology in section 3.4. The research design describes the nature of this study, including a description of the case and the unit of analysis. Design choices are reported, such as the strategies that were used to answer each research question (section 3.3.1). Issues of validity and reliability are discussed in sections 3.3.2 and 3.3.3 respectively.

3.3.1 Design choices

This investigation is an exploratory study, based on a **case study** of the Department of Telematic Learning and Education Innovation (TLEI) at the University of Pretoria in South Africa. The time period for this particular study was from 2001 to 2003, with scope for further research in an ongoing way, due to the nature of continuous improvement.

The unit of analysis (i.e. what is being analysed within the case) is the instructional design *process*. The embedded units of analysis (Yin, 2003a) are the web-supported learning opportunities that are designed and developed by

TLEI (these may be considered to be *products*, just as an *Apple* computer or a *Xerox* photocopy machine is a product of those respective companies).

According to the delineation of the case and the unit of analysis described above, the design of this study is a *single* case, embedded design (Yin, 2003a). The work done for various departments and faculties could be considered to be multiple cases, in some other research design, where a researcher may want to *compare* the instructional design process in different subject areas. In this particular research design, TLEI is a centralised unit, offering a centralised instructional design process. The various interventions are classified as *projects,* since a project management approach is adopted. No particular *projects* are analysed in this study.

Although conclusions that might arise independently in multiple cases could be more powerful and generalisable than those coming from a single case, the circumstances of this case study imply that I am part of the instructional design team and hence a participant observer. This single case may be considered *representative*[1], or typical of e-learning design and production units in other higher education institutions. The reasons this case may be considered representative of other e-learning units, are that instructional design practice recommends a team approach (Gery, 1987; Smith & Ragan, 1993), the clients served are lecturers and students and the instructional design *process* involves some form of digital mediation and interaction between lecturers, instructional designers and learners (Reeves & Hedberg, 2003).

This case study may also be described as an *instrumental* case study (Stake, 2000). This means that a particular case is examined and scrutinised and its activities are recorded and researched in an attempt to gain insight into an issue *(quality in web-supported learning)* and to inform understanding of the broader scenario.

[1] According to Yin (2003a) a representative case is a rationale for the use of a single case design.

An *evaluation* aspect is present in the case itself as well as in this study:

- in the case: the evaluation aspect is the regular formative and summative evaluation of web-supported learning opportunities (products);
- in this study: the self evaluation aspect is the analysis of the instructional design *process* (see section 2.8: *Conceptual framework*) in the pursuit of continuous improvement and measures to close the feedback loop (see Figure 3.1).

Although the *case* is singular, it has subsections and sub groups (Stake, 2000). In 2003, the instructional design team in TLEI consisted of 5 project managers, 12 instructional designers and 1 programmer. Other members of TLEI provide support in the design, development and implementation of e-learning interventions, for example education consultants, graphic designers, video and photographic experts. The *clients* of TLEI are lecturers who are involved in the design, presentation and facilitation of web-supported courses, and the students who are the end users of the products. Both groups of clients are role players and their feedback is a source of data to inform continuous improvement of the unit of analysis (see Figure 1.2: *Role players*).

The *criteria* by which the exploration will be judged successful (Yin, 2003a) may be viewed as the *programme objectives* of the intervention. In this case study, the intervention is the process-based quality management system for web-supported learning, in the full sense of the word *system* (see Figure 2.5). There is an epistemological tension between the practical objectives achieved by the intervention (the descriptive, the positivist, the concrete artifacts in the workplace) and the intellectual ideals striven for (the interpretivist, the relativist, the intangible understanding sought and distilled from the pragmatic experience, the journey towards growth and understanding). The practical objectives[1] are listed on the home page of the online QMS and are not discussed here (see Figure 6.2 and Appendix F7).

[1] Supplied by L.G. Boyd, personal communication, 9 October 2003.

The intellectual ideals seek understanding and explanation. They are:

1. to understand how standard quality assurance theory may be applied to the instructional design process with respect to web-supported learning;
2. to understand the interplay between quality of processes and quality of products;
3. to interpret client satisfaction in terms of summative evaluation of web-supported products in the quest for continuous improvement.

The achievement of these research ideals are reviewed and reflected upon in the final chapter of this thesis (chapter 7).

Table 3.1 gives an overview of the research strategies with respect to each of the three research questions that were presented in chapter 1. In section 3.4: *Research Methodology*, the sampling, instrumentation, procedures, data collection and data analysis are presented in detail.

Table 3.1

Research strategies with respect to the research questions

Strategy: / Research questions	Literature survey	Case analysis meetings	Student survey	Lecturer interviews	Expert consulta-tion	Task teaming
1. What factors promote quality web-supported learning?	X	X				
2. What factors contribute to client satisfaction (or frustration) with web-supported learning?	X		X	X	X	
3. What lessons were learnt in applying standard quality assurance theory to the instructional design process for web-supported learning?	X				X	X

The literature survey identified various factors to promote quality web-supported learning. These factors were synthesized into a taxonomy

(Table 2.3), which provided the inputs into the conceptual framework (Figure 2.5). Triangulation was provided via two case analysis meetings with critical colleagues whose input "combed" (Miles & Huberman, 1994) and refined the taxonomy. The findings for the first research question are presented in the form of the refined taxonomy together with a list of underlying assumptions and exogenous factors, as well as a graphic mapping of the taxonomy using ideas from the field of information science (chapter 4).

The literature survey also highlighted the importance of obtaining client feedback in order to measure the quality of web-supported learning (section 2.6). Client feedback informs the feedback loop with a view to continuous improvement of web-supported products. Therefore a student survey and lecturer interviews were used in order to answer research question 2. Expert consultation was also sought, with respect to the summative evaluation of products in order to provide measurements to inform the quality improvement cycle (see Figure 3.1). The student survey and the lecturer interviews are described broadly below and in more detail in section 3.4.3: *Procedures*.

I developed and piloted the questionnaire for the online student survey in 2001. Since then, it was refined and is now administered at the end of each semester (July and December) to all students at the University of Pretoria (both undergraduate and postgraduate), who participate in web-supported courses. The findings from July 2003 (4 650 respondents) are analysed and reported in this study (chapter 5). The same instrument was trialled by De Bruyn (2003) and Delport (2003) who used it in other research projects.

A small sample of lecturers (22) at the University of Pretoria who participate in designing and facilitating web-supported courses, were surveyed in February 2004, by means of personal interviews. This was a pilot experiment which enabled in-depth questioning of the participants and provided the opportunity to test and improve the interview schedule. A full-scale campus-wide investigation of client satisfaction with respect to *all* the services of TLEI is

planned as part of an impact study in 2005[2].

Research question 3 is answered by the evidence contained in departmental documentation and archival records, the activities of task teams and the artifacts they produced and expert guidance from a quality assurance consultant (chapter 6). This part of the case study is descriptive as well as exploratory. The findings from this part of the study can be described as those resulting after a reflective journey of the participant researcher.

Four criteria are commonly used to establish the quality of research designs in the social sciences: construct validity, internal validity, external validity and reliability (Yin, 2003a). These tests are discussed in the following subsections.

3.3.2 Validity

Construct validity in this study has been demonstrated by the careful analysis of the construct *quality* and of the constituent parts of a quality management system, such as *processes*, *products* and *clients*. These constructs were articulated in section 1.7.1: *Institutional context* and section 2.8: *Conceptual framework*. The construction of *quality assurance in higher education* in this study embraces continuous improvement in the search for excellence, with the emphasis on self-evaluation and a quality culture, rather than a culture of compliance (see sections 1.1: *Introduction* and 2.4.1: *Perspectives on the debate*). *Quality* terminology and *learning* terminology were clarified in chapter 1, as were the three knowledge domains: quality assurance, higher education and web-supported learning.

Construct validity in the student questionnaire was enhanced by basing it on validated categories and instruments from the literature (Hannafin & Peck, 1988 and Ramsden, 1991). The lecturer interview schedule was a newly developed instrument and part of this research effort was to validate and

[2] The impact study does not form part of this research study, but provides scope for further research.

improve it by piloting it. The suggestions for refinement of the instrument (section 4.3.4) enhance its construct validity for further research.

Although Yin (2003a) claims that *internal validity* applies only to explanatory and not to exploratory studies, a brief reflection is given here on the naturalistic equivalent of internal validity, namely *credibility* (Guba & Lincoln, 1981). This study made use of a participant researcher, peer examination of data and mechanical means to record, store and retrieve data. These are techniques used to address internal validity (credibility) (Le Compte & Preissle, as cited by Cohen et al., 2000).

A common threat to credibility is distortions in the data due to the researcher's presence at the research site, in other words, *observer effects*. In this study, being a permanent member of the instructional design team at TLEI, I was not regarded as an external researcher. However, my participation in the QMS Steering Team and the task teams meant that my input and my suggestions clearly influenced the nature and content of the artifacts produced. My contribution cannot be described as causing any distortions or bias however, since peer examination of the artifacts occurred when task team members reflected on their practice and reached consensus on the documentation.

With respect to the student survey, the data was electronically captured, generated and stored in html and Excel format. The fact that the data existed in various formats contributes to credibility, since the alternative formats were used to validate frequency counts. For example, when something appeared strange in the findings, such as the graphical distributions for two variables being identical, I could use the alternate data format to identify and correct the problem. Human error was minimized by using Excel to clean and code the data, except in the case of the open responses, in which human judgment was required in the coding of the responses. It would have been advantageous to repeat the coding exercise using different assistants to hand code different samples of open responses. However, repeating such an exercise several times over would still have been able to tap only a small proportion of the total number of open responses (4 650 respondents x 3 open questions each).

External validity can be thought of as synonymous with generalisability (Cohen et al., 2000; Yin, 2003a), in that it considers the *applicability* of a study's findings in a wider context (Guba & Lincoln, 1981). Yin (2003a) points out that in case study research, the idea is precisely not to attempt to generalise to other case studies, but rather to generalise to *theory*. That is what this case study aims to do: the themes and issues within instructional design practice and the need to merge the discourses of quality assurance and web-supported learning are universal phenomena experienced by many e-learning practitioners (personal communications, S. Celliers, 1 July, 2004; V. Greaves, 16 July, 2004).

Cronbach, as cited by Guba and Lincoln (1981), maintains that generalisations decay and that soon after they are made, they become history rather than science. Particularly in qualitative research, the major concern is often not generalisability; thus moving away from rigorous pressures to generalise is a small loss (Guba & Lincoln, 1981).

Specific aspects of generalisability of this study were described in chapter 1, section 1.9.3: *Generalisability*.

3.3.3 Reliability

Reliability is essentially a synonym for *consistency* and *replicability* over time and/or over groups of respondents (Cohen et al., 2000; Guba & Lincoln, 1981). In this case study, the different strategies used to answer the various research questions exhibit varying degrees of reliability, as discussed in the following paragraphs.

The literature review, which contributed to the taxonomy of factors to promote quality web-supported learning, was extensive, up-to-date and based on reliable sources, wherever possible (see section 2.2: *Literature sources*). The findings are corroborated by studies found after the synthesis of the taxonomy (see chapter 4). Further triangulation was provided by the case analysis

meetings, in which critical colleagues helped to confirm and refine the taxonomy.

The student questionnaire was piloted and refined for two years, prior to its administration in July 2003 (see chapter 5). It was also subjected to external evaluation by the South African Institute of Distance Education (SAIDE), which reported that both "the student and lecturer feedback instruments are very well crafted and the presentation of the student feedback findings in terms of satisfaction and frustration indices is illuminating" (T. Welch, personal communication, 22 June 2004).

In analysing the data from the student questionnaire, the goal was to calculate frustration and satisfaction indices. That analysis is based on my decision as to which questionnaire items indicate frustration and which items indicate satisfaction. This was done in consultation with a statistician who advised that a considerable amount of intuition and common sense is required in making such decisions when categorising data. Reid (2000) describes such decision making thus: "As with most real life studies, there were a number of decisions related first to data collection, and then to modeling the observed data, that involved considerable creativity…" (p.1335). Merriam (1998) also refers to the fact that data analysis (especially in qualitative research) is highly intuitive and that a researcher cannot always explain where an insight came from or how relationships among data elements were detected.

Threats to the reliability of the analysis of the open responses in the student questionnaire are the risk of human error and judgement in allocating codes. Furthermore, the coding frame was perhaps not sufficiently discriminatory, since too many responses had to be coded as "Other". The analysis will lead to improvements in the coding frame for future administrations of the survey.

Due to the nature of the satisfaction and frustration indices calculated from the student feedback data, it is expected that a pattern should emerge over time and over different groups of respondents, rather than precisely replicable findings over subsequent administrations of the instrument.

Indeed, Cohen et al. (2000) point out that "the premises of naturalistic studies include the uniqueness and idiosyncrasy of situations, such that the study cannot be replicated – that is their strength, rather than their weakness" (p. 119). The same can be said of the lecturer interviews in this study – due to the very fact that individual perceptions of benefits and problems experienced were mined, the results are particular to the individuals interviewed at the time and are not necessarily replicable. However, the intention was to tap into clients perceptions, in order to continuously improve practice and services. In that sense the data obtained was valuable and informative.

With respect to the task teams who reflected on and documented their practice, the nature of the field of instructional design and web-supported learning is so dynamic, that it is expected that the resulting procedures will require frequent updating. Nevertheless, valuable lessons were learnt about difficulties in the field and how to overcome them. This is the nature of an exploratory study.

3.4 Research Methodology

3.4.1 Sampling and participants

Samples were drawn in order to survey students and to interview lecturers. These samples are described respectively below.

Participation in the online student survey was voluntary, therefore the sampling technique may be described as a *self-selecting sample* [3] (A. Swanepoel - statistician, personal communication, 1 August 2003). The survey was administered *online* at the end of the first semester in 2003 (see section 3.4.3: *Procedures*). Of a population of approximately 17 000 students with WebCT courses, 4 650 participated in the survey, yielding a response rate of 27%.

[3] See discussion of possible bias in section 3.4.6

A purposeful sample was selected for the lecturer interviews. Lecturers known to be active in the implementation and facilitation of WebCT were specifically targeted, since they could make a valuable contribution to analysing the effectiveness of web-supported learning[4]. Twenty two lecturers were thus identified across the faculties of Education, Humanities, Economic and Management Sciences, Natural Sciences, Engineering / School of IT and Health Sciences (see Table 3.2).

Table 3.2 *Lecturer Experience and Satisfaction interviews conducted*

Faculty	Department	No. of interviews
Humanities	Psychology	1
	Visual Arts	1
Education	School for Teacher Training	1
	Centre for Evaluation and Assessment	1
	Centre for Augmentative and Alternative Communication	2
Economic and Management Sciences	School for Public Management and Administration	1
	Graduate School of Management	2
	Marketing and Communication Management	2
	Taxation	2
	Tourism Management	1
Engineering and the School of IT	Information Science	1
	Industrial Engineering	1
	Technology Management	1
	Mining	1
Health Sciences	Physiotherapy	1
	Anatomy	1
Natural Sciences	Chemistry	1
	Geography, Geoinformatics and Meterology	1
	Total:	**22**

[4] Barriers to web-supported learning are beyond the scope of this study, for example, lecturers who may have initially embraced and then later abandoned the use of web-supported learning for various reasons.

This section now describes the composition of the task teams which designed and developed the online quality management system (QMS) for web-supported learning. ISO practice recommends that one team (the *steering* team) should lead QMS projects, with smaller task teams to analyse, develop and document procedures (Vinca, 2004). In this case study, a QMS Steering Team led the development of the online QMS. This team consisted of all the e-learning practitioners that make up the instructional design team, namely 12 instructional designers and 5 project managers. The group consisted of 2 men and 15 women, ranging in age from early twenties to late forties, as well as the external consultant. Most of the team members are graduates trained in instructional design and the use of web-supported teaching and learning strategies and activities.

The smaller task teams were constituted from the QMS Steering Team, so their members were subsets of the instructional design team (see section 3.4.3: *Procedures: research question 3*).

3.4.2 Instruments

Formal instruments were designed for the student survey and the lecturer interviews:

- the *Student WebCT Experience* questionnaire (Appendix D1);
- the *Lecturer Experience and Satisfaction* interview schedule (Appendix E1).

Each instrument is described in further detail in this section.

Student questionnaire

The student WebCT Experience questionnaire consists of 27 closed items and 3 open items. I designed[5] the first draft instrument in 2001, based on the literature (Hannafin & Peck, 1988; Ramsden,1991) – see section 3.3.2: *construct validity*. Besides personal information, five categories were identified which reflected the issues to be investigated:

[5] This instrument is part of my original contribution to the field.

- personal information (4 items);
- technical adequacy and technical support (11 items);
- educational support (2 items);
- affective domain (feelings and emotions of students) (4 items);
- interactivity (use of the communication tools in WebCT) (2 items);
- instructional adequacy (perceived learning) (4 items).

The questionnaire was piloted during 2001 and 2002, after which the items and scales were refined and improved in consultation with the instructional design team. Since 2003 the questionnaire has remained almost unchanged, in order to enable longitudinal studies comparing results between semesters or from year to year (this provides scope for further research). The data from July 2003 thus provides a basis for monitoring change, improvement and the impact of web-supported learning, although the problems of bias due to the self-selecting sample are acknowledged.

The number of items in the questionnaire was kept to a minimum, so as not to frustrate the respondents with a lengthy questionnaire. For the closed questions, a 5-point Likert scale was used, ranging from *Strongly Agree* to *Strongly Disagree*. Open questions were kept to a minimum (three) and students were asked to give concise answers (in point form) to these three open questions. Issues and themes were identified by analysing a random sample of open responses, until data saturation[6] was observed, at which point analysis of the open responses was terminated (see section 3.4.5: *Data analysis*).

Lecturer interview schedule

The semi-structured interview schedule was designed and developed for lecturers to complete. The instructional design team was invited to comment on the content and structure of the items, thus contributing to its construct validity.

[6] Lincoln and Guba (1985) define data saturation as "continuing data collection produces tiny increments of new information in comparison to the effort expended to get them" (p. 350).

The interview schedule is a four-page document (Appendix E), which poses both closed and open questions. The closed questions are structured on a 5-point Lickert scale in the categories:

- overall effectiveness of the WebCT course (5 items);
- achievement of student learning outcomes (3 items);
- WebCT staff training attended (2 items);
- service provided by TLEI and the Academic Information Service (5 items).

Space is provided on the interview schedule to add further comments on the above items as well as for open questions in four categories:

- problems experienced (2 items);
- benefits experienced (2 items);
- impact of the e-learning product (1 item);
- overall evaluation (3 items).

The interview schedule was available in both English and Afrikaans, so that lecturers could choose their language of preference[7]. Participants were invited to make suggestions to improve the usefulness and relevance of the schedule. Scope for further research is to refine the schedule and administer it regularly to all lecturers at the university who have registered WebCT projects.

3.4.3 Procedures

The procedures followed with respect to each research question are described in this section.

Research question 1: Factors to promote quality web-supported learning

The literature survey investigated international frameworks to promote the quality of web-supported learning. During the early stages of the literature

[7] The student questionnaire was available only in English in 2003, but in both English and Afrikaans from 2004.

review (2002), studies relevant to the topic were informally identified. These studies were of two types: criteria to judge promising or exemplary online courses, or classic collections of benchmarks, indicators or principles that are often referred to in the literature. A comparative analysis of these studies was undertaken. Notes were made to summarise the factors, benchmarks or frameworks presented by the authors. Categories and factors which contribute to the quality of web-supported learning were identified and refined, in order to record frequency counts of the factors mentioned in each study. This resulted in a taxonomy of factors to contribute to quality web-supported learning (see chapter 2: Table 2.2).

During 2004 the ERIC database was searched for the topic *higher education* and *quality assurance* and *web-based instruction* (or relevant synonyms). Not all the search results were applicable to this research question, for example, some studies focused on topics such as assessment in e-learning, or broad distance education. Refinement of the search criteria identified additional pertinent studies published from 2000 onwards. These studies were then analysed for the purposes of corroborating and extending the factors in the taxonomy.

Miles and Huberman (1994) recommend that such a list of factors (or variables), needs to be “combed for redundancies and over differentiation” (p. 157). This means that the list should be reviewed to eliminate redundancy, to group similar factors together in one “box” and to tease out basic underlying assumptions. In order to enhance trustworthiness, the taxonomy was “combed” using the input and reflection of critical colleagues during two “case analysis meetings” (Miles & Huberman, 1994, p. 156). The colleagues are experienced instructional designers within the case study. Exhibit 3.1 shows part of the communication that took place with the critical colleagues.

Exhibit 3.1: Interaction with critical colleagues

E-mail message
From: Jill Fresen
Sent: 30 August 2004 16:30 PM
To: A,D and G
Subject: Factors for quality WSL

Dear A, D and G
Thank you very much for your valuable input this morning – I really appreciate your time and ideas.

I attach the original list of factors that we discussed, plus the "combed" list. I would really appreciate it if you are able to cast an eye over the combed list and see that I have not left out anything critical or misrepresented anything. I did delete quite a few factors, like "continuous improvement" and put them under "underlying assumptions".

The critical colleagues provided their input verbally during the case analysis meetings and via e-mail. I refined the taxonomy and sent it to them for their further discussion and final consensus. The resulting taxonomy is presented in the findings for the first research question (chapter 4, Tables 4.3 and 4.4).

Research question 2: client satisfaction

The completion of the online student questionnaire was voluntary and anonymous. The respondents were not identified in any way, since the goal was to calculate and compare levels of satisfaction and frustration and not to measure the extent of individual student learning. In the welcome message, students were assured of confidentiality, so that they felt comfortable that it was the course under scrutiny, not themselves.

The questionnaire was programmed by a programmer using phpESP software[8] (http://phpesp.sourceforge.net). It was implemented on *Student Online Services*, the campus-wide portal from where students access their WebCT courses. After the questionnaire had been made available online by the programmer and completed by the students, the programmer e-mailed me the data in Excel and html format.

[8] The WebCT survey tool was not used, since data collected that way has to be exported and re-formatted in Excel, which is time intensive and open to human error, especially if columns need to be manipulated.

Since the lecturer interview schedule was newly developed in late 2003, it was piloted during February 2004 with 22 lecturers who were known to be active in WebCT. Where possible, field notes were taken by the interviewer, when additional information emerged beyond the questions on the schedule. The interviews were guided conversations (Yin, 2003a), in which the questions on the interview schedule were posed by the interviewer, who probed further when issues were identified, or when the respondent volunteered additional information. The respondents were encouraged to be honest in their responses and to report any other impressions or needs not catered for by the semi-structured schedule. Responses were recorded by the interviewer by hand on the interview schedule, using additional space where necessary to record the richness of the open responses. The interviews were not recorded on audio or video tape.

In some departments, personal appointments were not possible for various reasons. These lecturers offered to complete the interview schedule in the form of a survey, which was submitted by e-mail or by post. This data was included in the analysis, but was less rich than that obtained during interviews, since self-completion of the schedule meant that respondents were less inclined to volunteer additional information. The issues that are analysed in the findings (chapter 5) derived primarily from the respondents that were interviewed.

After the interviews, a *thank you* letter was sent to each respondent in the interests of client relationship management and to express sincere appreciation for the time taken and honest opinions expressed.

Research question 3: process-based quality management system

In order to answer the third research question, namely to apply standard quality assurance theory to the instructional design process for web-supported learning, expert consultation was sought from an external quality assurance consultant. The scope of her work from 2001 to 2003 was to guide and facilitate the design, development and implementation of a formal QMS for web-supported learning (Boyd, 2001a). Her role was a consultative one.

She helped to plan and participated in the QMS Steering Team meetings and attended one of the small task team sessions. As the need arose, she produced documentation to prompt commitment from participants and to guide the writing of procedures[9] (see Appendix F). She reviewed and gave written feedback on all the checklists and procedures written by the task teams.

The procedures for this research question are summarised below according to four steps:

Step 1: training in quality assurance theory
Step 2: task team sessions
Step 3: paper-based prototype
Step 4: online version of the QMS

Step 1: Training in quality assurance theory

This step generated no data, but set the climate and prepared participants for their later activities in producing artifacts for the QMS. The consultant prepared and delivered face-to-face training workshops for the potential users of the QMS (Boyd, 2001b). The workshops facilitated the theory of quality assurance in terms of hierarchical ideas of processes, procedures and work instructions, as well as examples of how to document procedures, such as narrative, flow charts, diagrams or tables.

Additional training material (e.g. guiding questions, sanity checks etc.) was produced by the consultant when it became clear that participants had forgotten some aspects of the quality assurance training (see Appendices F7 and F8).

The theoretical framework which is the basis of the design of the QMS is shown in Figure 3.1.

[9] Her documents and ideas have been acknowledged where appropriate.

Figure 3.1. Elements of a quality management system
(Boyd, 2001b - adapted from Waller, Allen & Burns, 1993)

The quality management triangle in Figure 3.1 is based on Deming's Plan, Do, Control, Act cycle, a cycle of continuous testing and improvement, developed by W. Edwards Deming in the 1950s (Gabor, 1990). It summarises quality assurance theory and demonstrates visually how the feedback loop provides management information to continually act on and re-inform the cycle of continuous improvement.

Step 2: Task team sessions

Three QMS Steering Team meetings were held from February to July 2003. The responsibilities of the QMS Steering Team (adapted from Vinca, 2004) were to:

- identify team members to document each procedure;
- assign target start and completion dates for each team;
- identify training needs for employees and schedule training sessions (this was done in 2001 and 2002);
- meet on a regular basis to evaluate progress, answer questions and evaluate resource needs;

- review and approve procedures and supporting documentation submitted by the task teams.

The data sources during the Steering Team meetings were the agendas, minutes and additional notes which were recorded by hand by the participant researcher. Further details of these and other data sources are given in section 3.4.4.

At the first QMS Steering Team meeting, the group decided that the graphic version of the Project Timeline (based on the ADDIE model of instructional design – see Appendix F1) should be considered the main *process* for web-supported learning. At that time, the Project Timeline consisted of 17 boxes, each of which was to be documented as a formal *procedure*.

Traditionally, in designing and developing a QMS, one would complete each procedure, with its inputs and outputs, before going on to attempt the following procedure. This is in keeping with the *process chain*, one of the basic elements of Total Quality Management (Macdonald, 1998). In this case, in order to accelerate the development of the system, a rapid prototyping approach (Tessmer, 1993) was adopted. Each of the procedures was assigned to a small task team, consisting of 3 to 5 volunteers from the QMS Steering Team. A team leader was appointed for each task team, with the mandate to arrange and facilitate task team meetings and to submit the resulting documentation to the QMS Steering Team.

The responsibilities of the task teams were to:

- critically analyse their allocated procedure;
- review current supporting documents, such as checklists, forms, policies etc.;
- decide if supporting documents were to be retained, modified or discarded;
- develop new supporting documentation, if necessary;

- document the procedure according to a given example and template;
- circulate the draft procedure among all members for review;
- schedule next meeting.

Step 2 produced the first artifacts, which became components of the formal QMS, namely the allocated procedures documented according to the given template, together with all relevant supporting documents.

Step 3: Paper-based prototype

The next artifact produced was a paper-based prototype of the complete quality management system. Paper-based prototypes are generally underestimated in their usefulness and flexibility (Rettig, as cited in Nieveen, 1999). One way to create a paper-based prototype is to make a pile of papers representing parts of the system or the product and to have potential users 'walk through' them (Nieveen, 1999).

Figure 3.2. Paper-based procedure names according to the project timeline

At the second QMS Steering Team meeting, separate pieces of green paper were prepared, containing the names of each of the 17 procedures in the Project Timeline. These procedure names were laid out in a line on a long table. This provided a practical and visual representation of the structure of the QMS and made it easier for the participants to realise the value of documenting the procedures. Those procedures already documented by the

task teams at that stage were reviewed by the QA consultant and proposed changes were discussed and agreed upon by the Steering Team. Task team leaders were asked to implement the agreed changes in the documentation for their allocated procedure/s.

At the final QMS Steering Team meeting (24 July 2003), all the procedures documented by the task teams were put together to create a complete paper-based prototype of the proposed online QMS. The paper-based prototype consisted of a narrative description of each procedure together with all its supporting documents 

Step 4: Online version of the QMS

The final artifact produced was the online version of the QMS. This provided no new data, but was instead the culmination of weaving together the artifacts produced in steps 2 and 3. The online system was built using WebCT, the same learning management system used by students to access web-supported courses[10]. User testing of the system was done by a student assistant who concentrated on checking the technical functionality of the online system.

The online version of the QMS was launched and demonstrated to the Department of TLEI at the Quality Week celebration on 31 October 2003. TLEI users were given access after the launch and asked to evaluate the system informally. This involved them making sure that they could sign on to the system and working through it to identify areas for improvement in terms of usability. They sent their written comments to me, and the system was updated accordingly.

3.4.4 Data collection

The data collection methods from each of the data sources are described in this section.

[10] The reason for this choice was so that WebCT tools such as discussions and surveys could be used, as well as the fact that participant use of the system is tracked for later evaluation purposes.

Student questionnaire

Since the student questionnaire was administered online, the data was collected electronically. The data was exported from *Student Online Services* in two formats: html data (see Table 3.3) and raw data in Excel files. The latter was analysed for the purposes of this study.

Table 3.3. *Student WebCT Experience questionnaire: sample of html data*

12. What type of technical difficulties did you experience? (You may mark more than one option)

None	20.5%	(952)
Slow Internet access	54.2%	(2519)
UP network/server being down	31.8%	(1481)
My Internet service provider being down	10.1%	(468)
Logon/registration problems	21.1%	(980)
Too much material to download	15.2%	(705)
Attempted downloads were incomplete/aborted	17.9%	(831)
Lack of technical support	12.3%	(572)
Some links in the course did not work	23.6%	(1099)

13. How often did you experience technical difficulties of any sort?

Less than once per week (e.g. 3 times per semester)	73.0%	(3395)
1 to 5 times per week	23.6%	(1097)
6 to 10 times per week	2.3%	(105)
More than 10 times per week	1.1%	(53)

The html format is easier for interested parties to read and interpret, since it automatically displays frequency counts and bar charts for each item. This data was distributed directly to TLEI management and project leaders in academic departments.

Lecturer interviews

Data was collected during the lecturer interviews by completing the semi-structured interview schedule. Where possible, field notes were taken when additional information emerged beyond the scope of the schedule.

Documentation, archival records and artifacts

Three sources of data were used for the process-based quality management system for web-supported learning, namely documentation, archival records and artifacts (Yin, 2003a):

Documentation:

- communiqués between myself and the consultant (telephone, e-mail and face-to-face) and between members of the task teams;
- agendas, notes and minutes which I recorded on paper at the QMS Steering Team meetings and task team sessions.

Archival records:

- administrative documents and internal records, e.g. Roles and Responsibilities (Fresen, 2000), the Instructional Design Toolkit (Fresen, 2001), the sample project proposal, guidelines for project proposals and the funding policy.

Artifacts:

- procedures and supporting documentation generated by the task teams and the paper-based prototype of the online QMS.

According to Ellis & Bochner (2000), there are a myriad of equivalent terms for such qualitative data collection, for example, autoethnography, personal narrative, first-person account or ethnographic short stories. I did not formally record everything at the time it happened, but later reconstructed the journey from the above data sources. The final artifact which was produced after all the steering team and task team meetings was the online version of the QMS (Figure 3.3).

Figure 3.3 Home page of the quality management system (2002)

3.4.5 Data analysis

Student survey

The data was coded, transformed and categorised as described in Appendix D2. A brief overview of the steps is given here:

Step 1: The Excel data was converted from alphanumeric format to numeric codes using programming statements in Excel.

Step 2: Multiple response items (sometimes up to ten possible response options) were transformed by creating single variables with binary response options (e.g. 0 implies no technical difficulties, 1 implies technical difficulties of some sort).

Step 3: Items were classified as contributing to either student frustration or satisfaction, in order to calculate a Frustration Index (FI) and a Satisfaction Index (SI):

Table 3.3: *Categories classified according to the implication of either frustration or satisfaction*

Frustration categories:	Technical adequacy and technical support (TA)
	Educational support (lack thereof) (ES)
	Affective domain (AD)
Satisfaction categories:	Communication tools (CT)
	Perceived learning (PL)

Step 4: For each respondent, the Frustration Index (FI) was computed in Excel as the sum of intermediate indices in the three *frustration* categories. The Satisfaction Index (SI) was computed in Excel as the sum of intermediate indices in the two *satisfaction* categories.

S-PLUS was used to plot the distributions of all the indices and variables (see distributions of the *indices* in chapter 5 and distributions of each *variable* (questionnaire items) in Appendix D5). Plotting the distribution of a variable yields a full record of its behaviour, rather than estimating its behaviour based on measures of location and spread (means and variances).

During the pilot administrations of the student questionnaire in 2001 and 2002, a coding frame was generated by analysing and categorising the responses to the open questions. The resulting items in the coding frame therefore summarise the themes and issues which emerged from the early analysis of open responses. (see Appendix D3). A subset of the open responses collected in July 2003 were coded by hand, using the coding frame generated during the pilot stage. This can be considered a first level content analysis: it was important to allow salient themes and issues to surface (Stake, 2000), and not to analyse the responses verbatim (examples of such salient issues are technical reliability, interaction with lecturers etc.).

Due to the large number of respondents (4 650 respondents who answered three open questions each), a point of data saturation was reached, after

which no new issues or themes were identified. At that point the analysis of any further open responses was terminated. The results of the student survey are reported in chapter 5.

Lecturer interviews

The data collected from the lecturer interviews originated from both closed and open responses. It was summarised by hand and reported anecdotally according to themes and issues identified. The intention was for this qualitative data to inform the practices and improve services offered by TLEI, so it had to be considered and interpreted in rich detail, without any loss of information.

The evidence from the lecturer interviews is presented in chapter 5, after the findings from the student survey. Care was taken to present the evidence separate from any interpretation and to explore alternative interpretations (Yin, 2003a). The semi-structured interview schedule meant that certain themes had previously been identified by the researcher[11], for example, problems and benefits experienced with respect to course development and course facilitation.

The responses to such items were analysed in terms of the issues that were volunteered by the lecturers. The frequency of the issues was tabulated and summarised (an analytic manipulation recommended by Miles and Huberman, 1994). Where relevant a graph was presented, for example, to represent visually the comparison between the levels of service received from different role players in the project team.

Documentation, archival records and artifacts

No formal analytic manipulations by the researcher, such as content analysis, pattern matching or time series were applicable, since peer review and consensus ensured acceptance of the artifacts.

[11] This is an example of *etic* data, as opposed to the *emic* data volunteered by the respondents.

The internal documents and archival records were already in use in practice. The communiqués and notes were recorded on paper or electronically in the case of e-mail messages. The agendas and minutes of the QMS Steering Team and task teams were considered when documenting and improving the procedures and supporting documents. All this data was used in an ongoing way to make decisions throughout the work of the task teams, for example notes taken during the QMS Steering team meetings were used by the team leaders to implement edits to particular procedures. In this way, the data contributed to the development of the artifacts and to the final online QMS.

The artifacts generated by the task teams were in the form of electronic procedures and supporting documents (such as checklists, QA report) for each of the procedures in the Project Timeline. The second draft of each procedure was saved in MS Word and Adobe Acrobat format and the latter, together with applicable supporting documents, was uploaded into the online version of the QMS. All the documentation may be considered to be working documents, since they are not static but always subject to review and improvement.

The findings in the form of lessons learnt on reflection by the participant researcher, and artifacts generated and incorporated into the QMS, are reported in chapter 6.

3.4.6 Justification for and limitations of the research methodology

e sample for the student survey was a self-selecting one. Taylor, Woodman, Sumner and Blake (2000) describe self-selecting samples as follows: “There is always an element of self-selection in the return of questionnaires – this hazard is always present” (online reference). Although such a sample cannot be viewed as representative of the population, the intention in this study was to gather client satisfaction data and not to describe or draw inference about the whole population of WebCT students. Even so, it is acknowledged that only certain types of students, such students with strong opinions, may have responded to the questionnaire.

The student questionnaire was delivered to WebCT students online. Online questionnaires have the advantage of providing extensive coverage of a large population at no additional cost (Taylor et al., 2000). Furthermore, the captured data is already in electronic format. A paper-based questionnaire to be completed in class time would have had the disadvantages of being time consuming and involving several people, such as lecturers or tutors, to administer it. The advantage of a paper-based questionnaire would have been a random instead of a self-selecting sample. Since the questionnaire was about the WebCT experience, it was advisable for students to complete it online rather than via non-electronic media, so that the respondents were physically and intellectually close to their web-supported learning experience.

However, being an electronic survey may also have introduced an element of bias, in that the questionnaire may have been completed by students who

a. were more computer literate, or
b. had ready access to computers, or
c. had the time and energy to complete it online, or
d. had a specific point of view to express (either strongly positive or strongly negative).

A factor which may have favourably influenced the completion rate of the student survey is that it was administered at the end of the semester, but before examinations were written and final results obtained. The intention was to attract a higher response rate as students prepared for examinations, rather than lose many of them when they no longer had a need to access their online courses.

Taylor et al. (2000) caution further that although questionnaires provide data about preferences, trends and patterns of behaviour over time, they usually do not provide deep and meaningful evidence of actual student learning.
It is acknowledged that the measurement of actual student learning (Kirkpatrick's, (1998) Levels 2 and 3) provides scope for further research. Such measurement will provide further evidence to inform the quality cycle

and to substantiate return on investment for University management (Kirkpatrick's (1998) Level 4).

An unexpected benefit of the personal interviews with lecturers was that the interviewer had a chance to renew client relationships, especially with established clients whose WebCT courses had been running for some time. The sample of lecturers was small, but it was a pilot administration of the interview schedule, with the intention of improving the instrument for future administrations.

Although participant observation in a case study provides certain unique opportunities, a major problem is that of possible bias (Yin, 2003a). The participant researcher may be so closely involved in the daily situation that firstly, she may be a biased supporter of the group of participants and secondly, her efforts may be concentrated too intensely on the participant role and not directly on the observer role. In this case study I was a direct member of the instructional design team and therefore of the QMS Steering Team and various task teams. In facilitating the task teams of which I was the team leader, I concentrated on trying to be an outsider and prompted the participants to critically review what they were doing, why they were doing it and how their practice could be improved. Task teams then reached consensus on their allocated procedures, which were later reviewed, edited if necessary and adopted by the QMS Steering Team.

For practical reasons, a researcher is compelled to limit the literature search in terms of quantity and publication dates of studies. The studies analysed in search of factors to promote the quality of web-supported learning are not necessarily the only such studies. Of the studies found on the ERIC database the abstracts were read and assessed for their relevance to the topic. After a refined search, nine studies plus others previously identified, were reviewed with respect to the extent of their corroboration of the synthesized taxonomy.

The taxonomy in Table 2.3 collates, synthesizes and categorises a variety of contributing factors into a practical framework. There are some problems associated with collating and interpreting such qualitative data, for example:

- In re-wording categories and items, the results are dependent on the researcher's interpretation of what the authors intended to imply.
- The similarity of items enabled some to be grouped together, which would not necessarily be done in the same way by any other researcher.
- There may well be many items which are not listed, not because they lack importance, but because they were not thought of in any of the specific studies, or were not relevant to the author's point of departure at the time (e.g. Alley (2000) specifically states that he is considering neither institutional nor uncontrollable factors).

These threats to confirmability (objectivity) and auditability (reliability) should not detract from the value of this exercise, since it is an exploratory attempt to synthesize qualitative data. Such threats do not necessarily detract from qualitative approaches, due to the insights that may emerge (Guba & Lincoln, 1981).

3.5 Summary

This chapter presented the research philosophy, design and methodology for this exploratory study. During the course of this study, my epistemological viewpoint evolved into an interpretivist, phenomenological approach, as a result of trying to understand the phenomenon of quality of web-supported learning in higher education.

This study is a case study of TLEI, which is the centralised e-learning support and production unit at the University of Pretoria, South Africa. The unit of analysis is the instructional design process. The embedded units of analysis are the web-supported learning products produced. The clients of the e-learning unit, namely lecturers and students, provided a source of data

which contributed to answering some aspects of the research questions.

The research design was summarised in Table 3.1. It included the following strategies:

- a literature survey to investigate factors to promote the quality of web-supported learning;
- an online student WebCT Experience survey administered in July 2003 (4 650 respondents);
- lecturer interviews conducted in February 2004 (22 respondents);
- task teams and expert consultation for the design and development of the process-based quality management system for web-supported learning.

Two formal instruments were used to measure client satisfaction (or frustration) with web-supported learning (research question 2), namely the student *WebCT Experience* questionnaire (Appendix D1) and the lecturer *Experience and Satisfaction* interview schedule (Appendix E1). The sampling techniques were self-selecting and purposeful samples respectively.

The data from the student survey was automatically generated by the software package, in html and Excel formats. The graphic html data was distributed to TLEI management and project leaders in academic departments. The Excel data was coded and transformed using programming statements in Excel. SPLUS was used to produce full statistical distributions in graphic format for all the indices and variables which contributed to client satisfaction. Satisfaction and frustration indices were calculated by accumulating contributing variables and calculating the extent of satisfaction or frustration respectively.

The qualitative data from the lecturer interviews was analysed by hand by identifying issues which were summarised and tabulated. The findings from the student and lecturer surveys are presented in chapter 5.

Task team participants consisted of the entire instructional design team of TLEI, namely 2 men and 15 women, mostly with postgraduate qualifications in

instructional design. Three QMS Steering Team meetings were held from February to July 2003, in which the instructional design process was analysed into its constituent procedures, all of which were analysed and documented in detail by smaller task teams, thus producing artifacts which became components of the online QMS.

Documentation, archival records and artifacts were the main data sources from which both the paper-based prototype and online version of the QMS were developed. The online version was implemented in October 2003 and will be evaluated in practice as part of further research initiatives.

Possible bias is acknowledged in that the participant researcher was an integral part of the case study. However, the value of participant observation and learning from the particular cannot be underestimated: "Qualitative case study is characterised by researchers spending extended time, on site, personally in contact with activities and operations of the case, reflecting, revising meanings of what is going on" (Stake, 2000, p. 445).