CAUGHT IN THE WEB OF QUALITY

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Terminology

The term *e-learning* generally embraces a variety of electronic delivery media, for example web-based, multimedia on CD-Rom, interactive television, virtual classrooms and video conferencing (American Society for Training and Development, n.d.). Internationally, the term *distance education* has become synonymous with *online learning*, which is sometimes also referred to as *technology-assisted distance learning*. The phrases *technology-enhanced learning* or *internet-based distance learning* are also used (Barker, 1999). The preferred term in this case study is *web-supported learning*, which implies that the Internet is used as a supportive delivery medium in a blended learning model.

Introduction

At a keynote address at the Ed-Media Conference in 2001, the speaker concluded with a Call to Action "*to articulate frameworks for quality online courses"* (Bitter, 2001). The findings in this study provide a response to that call, as well as to a perceived gap in the international body of knowledge of quality assurance of web-supported learning.

Further motivation is provided by a study conducted by Van der Westhuizen (2002), in which the quality audit manuals of 12 countries were analysed. In only two cases was quality management of distance education mentioned, with no mention at all of quality approaches to web-supported or e-learning.

Quality is an elusive and ill-defined concept (Harvey & Green, 1993). In everyday life we have become accustomed to associating quality with fancy features, high prices, zero defects and conformance to specifications. In the field of higher education, we speak of 'best practices', 'excellence', 'quality learning interventions', 'instructional design standards', etc. How do we interpret quality in web-supported learning and how should we balance the need for both qualitative and quantitative measures of such courses? This study investigates quality

assurance (QA) of web-supported learning and may be considered an exercise in self-evaluation of an academic support unit at a higher education institution.

The case study

This paper reports on a case study located at the University of Pretoria, South Africa. The department which is responsible for teaching and learning support, academic staff development and education innovation is the Department of Telematic Learning and Education Innovation (TLEI), within which the E-Education Unit provides development and training support to academics with respect to e-learning. Education innovation is one of eight strategic drivers at the University of Pretoria (University of Pretoria, 2002). Among other initiatives, this translates into the promotion and expansion of web-supported learning as one of the strategic objectives of TLEI (TLEI, 2003).

The learning model promoted at the University of Pretoria is one of flexible, blended learning. That is, flexibility is created in terms of entrance to academic programmes, delivery modes, methods of assessment, and time, place and pace of study. In general, the main teaching method is contact sessions in the form of traditional lectures, tutorials and practical sessions. These are supplemented by a mix of other delivery media, where appropriate to enhance the learning situation, for example web-supported learning, interactive television, stand alone multimedia and video materials.

In 2001 the E-Education Unit contracted an independent quality assurance consultant to provide staff training and to facilitate the implementation of a quality management system for e-learning. A conscious decision was made not to seek ISO 9001 certification initially, but all components of that standard were taken into account. Therefore the system is adaptable to ISO 9001 requirements, should certification be sought at a later stage.

Role players in the case study may be divided into three groups: stakeholders, clients and practitioners. They are the key individuals who support the 'web' of web-supported learning. The use of the word 'web' in this sense refers to the complex interrelationships and functions between the various individuals. This 'rich picture' (Checkland, 1999) of interrelationships often hampers attempts to implement quality principles and practices in the field of education (Elton, 1993). It is compounded by the universal tension between self-evaluation and external accountability (Genis, 2002), part of the 'quality debate', which is discussed in the next section. The role players in the case study are illustrated in Figure 1.

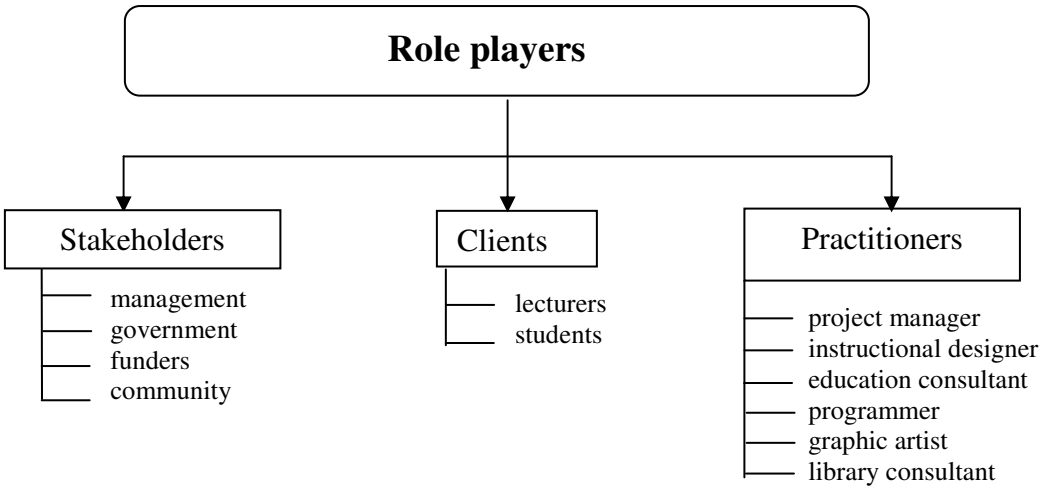

Figure 1: Role players in the case study

Stakeholders with an interest in the quality of web-supported learning are management of the University, government quality agencies, funders who may contribute to development costs and the broader community, such as parents and employers. The direct *clients* of web-supported learning are the academic staff (lecturers) who wish to adopt education innovations in the form of technology-enhanced delivery and facilitation of learning materials. The ultimate *clients* are the students taking web-supported courses that have been designed, developed and implemented by TLEI.

The *practitioners* listed in Figure 1 are typical of those to be found in any e-learning production team in a higher education institution (Gustafson & Branch, 2002; Smith & Ragan, 1993). They have a role to play as change agents in re-shaping the paradigms and enlisting the commitment of lecturers and students towards e-learning in general and web-supported learning in particular.

Case studies in the field, which are similar and yet focus on different aspects of quality, are the University of Southern Queensland's Distance Education Centre (DEC) and the University of Bangor in Wales. The former is the first distance education facility in the world to receive international quality accreditation to ISO 9001 standards (University of Southern Queensland, 2002). The latter study developed a quality assurance system which provides a series of tools and guidelines to assist users in judging the pedagogical quality of computer-based learning resources (Sambrook, Geertshuis & Cheseldine, 2001). In addition, the European Quality Observatory (EQO) was launched in 2004. The EQO is an online database of metadata relating to quality approaches in e-learning (Hildebrandt & Teschler, 2004). This study is registered in the EQO, thus promoting its visibility and generalisability.

This paper reports on three components of the case study described above. The three components are:

- The implementation of a formal *online* quality management system (QMS) in respect of the e-learning processes, products and services in the Unit.

- The synthesis of a framework of critical success factors for web-supported learning.
- The design, administration and analysis of a student feedback survey, in order to measure student satisfaction with web-supported learning. It is acknowledged that lecturer feedback also forms a key part of client satisfaction, an issue which has been addressed in pilot form in the newly formulated summative evaluation procedure.

The above three components are reported in this paper as Parts I, II and III.

The Quality Debate

The debate in QA circles on self-improvement versus external accountability is well documented (; Baijnath & Singh, 2001; Boyd & Fresen, in press; Jeliazkova & Westerheijden, 2002; Newton, 2002; Ratcliff, 1997; Van der Westhuizen, 2000; Vroeijenstijn, 1995). The particular QMS in this case study was designed and developed according to a conscious decision to concentrate on self-evaluation and improvement, rather than accountability requirements placed on practitioners by an external quality assurance agency. The danger of the latter approach is that it tends to breed a culture of compliance, simply for the sake of compliance (Baijnath, Maimela & Singh, 2001; Barrow, 1999; Boyd, 2001a; Singh, 2000; Vroeijenstijn, 2001;). Jeliazkova and Westerheijden (2002) describe the dangers of such compliance as *"routinisation, bureaucratization and window dressing"* (p. 434).

Fourie (2000) confirms the need for practitioners to develop their own meaningful efforts at continuous improvement *"at various levels of the institution and in various areas"* (p. 51) (such as e-learning). She underlines the rationale for such systems:

> *"In higher education worldwide there has been a shift from quality control to quality assurance. This implies that institutions (providers) are required to establish their own quality management systems... In this way, the overall responsibility for assuring quality is placed as close as possible to the individual organization or sub-unit providing the education service"* (p. 51, referring to Lategan).

The 'quality' discourse and the 'e-learning' discourse are closely linked, yet until recently, there has been little overlap between them (Reid, 2003). The merits of e-learning are neither debated nor defended here. Rather, this study attempts to bring the two discourses closer together by applying quality assurance theory to the field of web-supported learning, in the context of the e-learning design and production unit at the University of Pretoria.

Quality Assurance in Higher Education in South Africa

Quality assurance as a focus area in South African higher education is a relatively new phenomenon and is still in its formative stages of development (Baijnath et al., 2001; Kistan, 1999; Moore, 2001; Singh, 2001; Steyn, 2000; Woodhouse, 2000). After the establishment of a democratic government in 1994, various acts of parliament were passed and national quality agencies constituted, representing part of our nation's attempt to standardise and legitimise the education and training system.

Responsibility for quality assurance at universities was assigned to the Higher Education Quality Committee (HEQC), which was constituted in March 2001 (Singh, 2001). The HEQC is concerned with strategic and conceptual issues of quality in higher education, with responsibility for programme accreditation, quality promotion and institutional auditing (Baijnath & Singh, 2001; HEQC, 2000).

The Distance Education Quality Standards Framework for South Africa (Department of Education, 1996), defines necessary quality assurance arrangements for distance education as follows:

> *"1. The management ensures that, in its day-to-day work, the organization's activities meet the quality standards set nationally as well as the organization's own policy for the different elements regarding teaching and learning, management and administration, finances, human resources and marketing.*
> *2. There is an organizational culture that encourages efforts to improve the quality of the education.*
> *3. There is a clear cycle of planning, development, documentation, reporting, action and review of policy and procedures within the organization.*
> *4. Staff development is seen as fundamental to quality service provision.*
> *5. There are clear routines and systems for quality assurance and staff are familiar with those that relate to their work.*
> *6. Staff, learners and other clients are involved in quality review.*
> *7. Internal quality assurance processes are articulated with external processes."* (online reference)

The QMS in this study strongly reflects items 2 to 6 above. Staff training workshops presented in 2001 and 2002 addressed items 2 and 4, with respect to the theory of quality assurance. Items 3, 5 and 6 form the heart of the QMS, with emphasis on daily work procedures, as well as formative and summative evaluation of web-supported learning products. Items 1 and 7, namely national quality standards and external processes, will follow later, in preparation for institutional audits by the HEQC in the near future.

Part I: Methodology for the Quality Management System (QMS)

The first step in ensuring ownership and commitment of the instructional designers and project managers who are the users of the QMS, was to provide training in the theory of quality assurance. The 'Introduction to Quality Assurance' workshop was presented to the TLEI management team in November 2001, and in small groups to all the members of the E-Education Unit from November 2001 to May 2002 (Boyd, 2001b).

The training workshops presented, among other things, the theory of quality assurance and quality management systems, the hierarchical notions of processes, procedures and work instructions, as well as examples of how to document procedures, such as narrative, flow charts, diagrams or tables. The workshops also gave an opportunity for participants to voice their issues and concerns, and make suggestions. This engendered ownership and involved everybody from a change management point of view.

The theoretical framework which forms the basis of the design of the QMS was presented in the workshops and is shown in Figure 2.

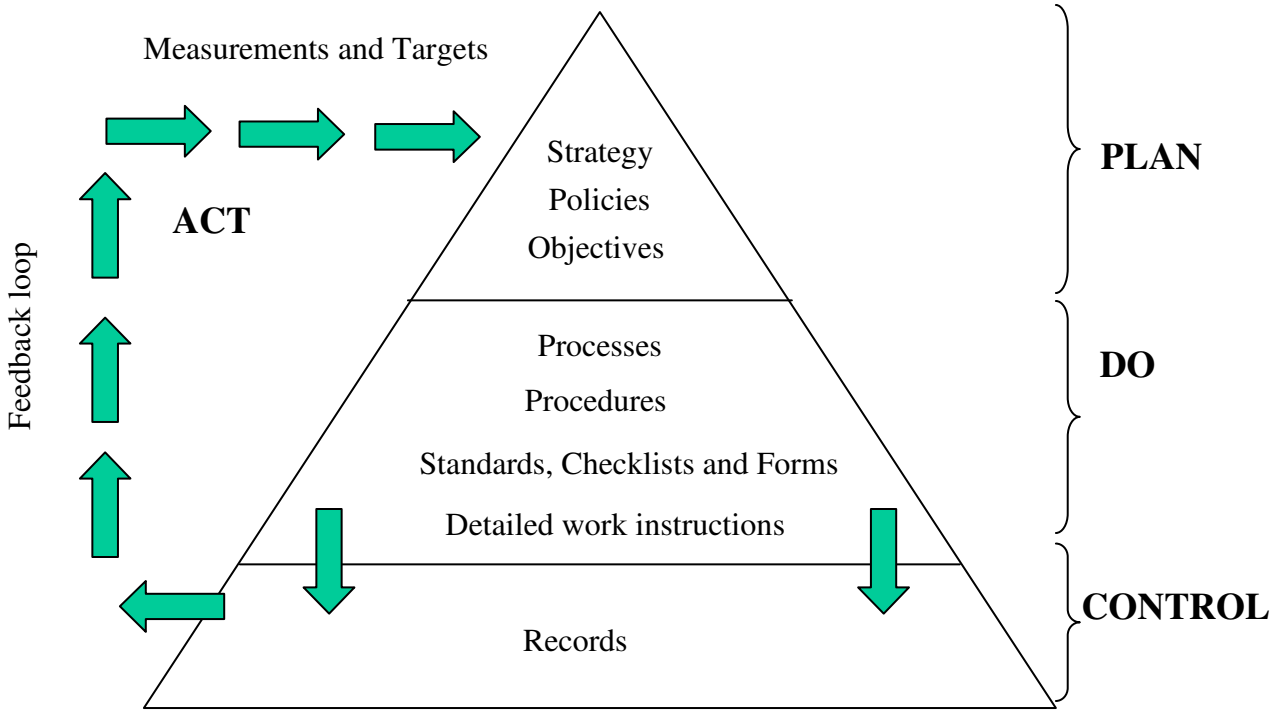

Figure 2: Elements of a Quality Management System
(Boyd, 2001b - adapted from Waller, Allen & Burns, 1993)

The quality management triangle in Figure 2 was adapted to include Deming's Plan, Do, Control, Act cycle, a cycle of continuous testing and improvement, which Deming taught in his earliest lectures in Japan (Gabor, 1990). It demonstrates visually how the feedback loop provides management information to continually act on and re-inform the cycle of continuous improvement. It also reflects the cycle of formative and summative evaluation inherent in the traditional ADDIE (Analysis, Design, Development, Implementation, Evaluation) instructional design model (Gustafson & Branch, 2002).

Instructional design practice in the E-education Unit had generated a collection of documentation, including a Project Timeline, a Service Level Agreement, a Roles and Responsibilities document and Minimum Requirements for web-supported courses. These documents were an intuitive attempt to streamline and improve the processes and procedures of the Unit and were later included as supporting documentation in the online QMS.

The Project Timeline, based on the ADDIE model, became the major *process* (i.e. the instructional design *process*) on which the QMS is based. It consisted at that time of 15 steps, later compacted to 12, each of which was workshopped and brainstormed into a fully documented *procedure*. The Project Timeline is shown in Figure 3.

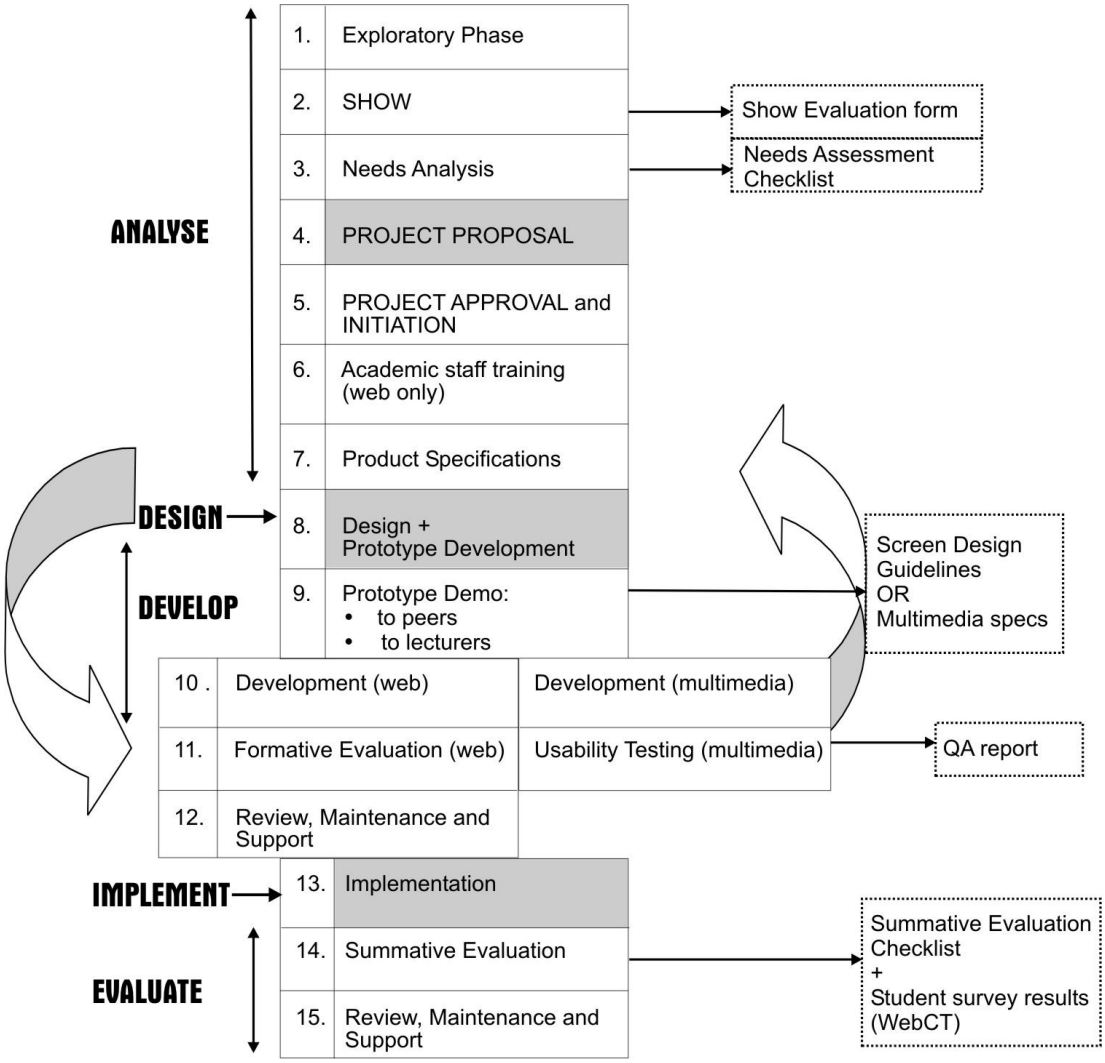

Figure 3: Project Timeline, reflecting the ADDIE model of instructional design

In keeping with the philosophy underlying the implementation, namely the active participation of the instructional designers and project managers who are the users of the QMS, they were invited to attend a series of 'jigsaw and pizza' workshops, which turned out to be valuable self-evaluation exercises. Separate pieces of green paper were prepared, containing the names of each of the procedures in the Project Timeline, the pieces of the jigsaw puzzle. These procedure names, each with their existing supporting documentation, were laid out in a line on a long table. This provided a practical and visual representation of the QMS, to make it easier for the participants to realise its importance and value and what would be required of them in documenting each procedure.

Due to time constraints, a rapid prototyping approach was adopted. 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). At the first 'jigsaw and pizza' meeting, we constituted task teams to brainstorm and document each

of the procedures in the Project Timeline. Task teaming is an accepted methodology for developing quality management systems (Vinca, 2004). Each task team was asked to go away and document their procedure, according to a template, example and self-evaluation questions provided by the QA consultant.

The rapid prototyping approach involved a certain risk due to the need for teams to collaborate with each other regarding their inputs and outputs. However, this occurred without encouragement, since most team members belonged to more than one task team, and so an automatic cycle of formative evaluation occurred naturally as they discussed and documented each procedure. Two months later, we convened two follow-up 'jigsaw and pizza' meetings, at which we put all the pieces of the puzzle together and created 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 the supporting documents such as checklists, guidelines, pro-formas and policies referred to in each procedure. An agreed template was followed, consisting of the following headings:

- the title of the procedure;
- an overview of the procedure;
- the objectives of the procedure;
- list of numbered procedure steps;
- responsibilities of all the role players;
- list of supporting documents and outputs;
- footer giving document control data.

Each procedure is a maximum of three A4 pages (using Arial, size 11), where feasible.
A system of icons indicates which supporting documents are mandatory and which are optional, to be used at the discretion of either the project manager or the instructional designer.

The *procedures* form the backbone of the online QMS and are available as *.pdf documents in the system, together with links to their relevant supporting documents. One aspect which was not covered in the one dimensional Project Timeline, was the involvement of the various role players in each procedure. This was solved by evolving the Project Timeline into a two-dimensional QMS site map, in which each procedure along the horizontal axis is matched with the respective role players on the vertical axis, with the major outputs described in each cell of the matrix. The QMS site map enables users to view the entire instructional design process and to make use of hyperlinks to navigate among the various procedures.

A summative evaluation of the online QMS itself is planned after team members have had the opportunity of using it in practice.

Part II: Critical success factors for web-supported learning

Six studies from the literature were reviewed to give an overview of the benchmarks, tools and frameworks proposed by the respective authors. The studies selected were:

1. WebCT® Exemplary Course Project (Graf & Caines, 2001)
2. Quality on the Line (Institute for Higher Education Policy, 2000)
3. Quality indicators (CACE) (Barker, 1999)
4. Seven Principles (Chickering & Ehrmann, 1996)
5. Ten Keys (Alley, 2000)
6. Pedagogical framework (Herrington, Herrington, Oliver, Stoney & Willis, 2001)

Each of the above studies approached the notion of quality in online learning from different perspectives and under different conditions. These particular examples were selected since they are based on extensive research projects in Canada, the USA and Australia, some of them on a large national scale. They are often referred to in the literature and indeed, refer to each other, but we have seen no comprehensive comparison or synthesis thereof. By synthesising the key factors for quality web-supported learning from these studies, an overall framework of critical success factors is proposed (see Table 1). The full description and analysis of each of the above studies is given by Fresen (2004).

Most such collections of guidelines or best practices classify their factors into categories such as institutional support, course development, teaching and learning, course structure and student support (Institute for Higher Education Policy, 2000) or institutional context and commitment, curriculum and instruction, faculty support, student support, evaluation and assessment (Western Interstate Commission for Higher Education, 2001).

For the purposes of this synthesis, the following categories are suggested, which appear to be a reasonable synthesis of the type of factors used in the literature:

- institutional factors;
- technology factors;
- lecturer factors;
- student factors;
- instructional design factors;
- pedagogical factors.

The critical success factors for quality web-supported learning are synthesised in Table 1, according to the above classification. In some of the literature studies, an item may have been mentioned in further discussion, not necessarily listed as a main benchmark. All such items *are* listed explicitly in Table 1.

Table 1: Critical success factors for quality web-supported learning

Category	Factor
Institutional factors	Technology plan
	Infrastructure / adequate resources for web-supported learning
	Student advice and consultation (with respect to courses, careers, bursaries etc.)
	Institutional evaluation of programme effectiveness
Technology factors	Reliability / robustness
	Accessibility / 24-7 availability
	Technical support for lecturers and students
	System training for lecturers and students
	Appropriate use of technology
	Accurate management of student records / data
Lecturer factors	Interaction with students / facilitation of web-supported learning
	Frequent and constructive feedback to students
	Academic background / qualifications
	Professional training in education / professional development
	Regular evaluation of lecturer competence
Student factors	Communication with fellow students
	Time management / time on task
	Learner control over time, place, pace of learning
	Expectations of efficiency and effectiveness with respect to web-supported learning
	Employ critical thinking strategies
	Motivation / commitment / self esteem
	Improve problem-solving abilities
	Return on client's investment – client satisfaction, cost/benefit
	continued…

Table 1 (continued): Critical success factors for quality web-supported learning

Instructional Design factors	Co-operative / group learning / team work / reciprocity
	Student engagement in higher cognitive levels / knowledge construction / challenges
	Rich learning resources / Sound learning materials
	Interactivity / Active learning / learning activities
	Enhanced student motivation / responsibility for own learning
	Design standards / guidelines / minimum requirements
	Manageable segments / modular / chunking
	Inclusivity: social, cultural, gender, disabilities
	Routine review and evaluation of courses / products
	Purposeful use of learning media
	Usability / Minimise student frustration / appealing
	Appropriate use of images, graphics
	Offer a complete learning package
	Appropriate layout and presentation
	Appropriate bandwidth and download demands / speed
Pedagogical factors	Learning outcomes / objectives are clearly stated
	Optimal assessment strategies / authentic tasks
	Respect diverse talents and learning styles
	Clearly stated expectations re: minimum levels of participation, assignment completion
	Communicate high expectations
	Provide time for students' self reflection
	Provide a non-threatening, comfortable environment
	Offer multiple paths for recursive learning
	Provide a learner-centered environment
	Students instructed in proper research methodology
	Relevance and accuracy of content
	Currency of learning resources and content
	Research and continuous improvement

The factors in Table 1 show in essence, the importance of communication, interaction, 'good' instructional design principles and 'good' pedagogical principles, based on a solid foundation of institutional and technical stability, support and training for lecturers and students. Instructional designers and project managers need to consider all these aspects in attempting to assure quality in the web-supported learning experiences they design and implement.

It became clear during the analysis of the six studies, that some issues are so important that they should be considered a given (underlying assumptions), without which e-learning would not be sustainable. Examples of such assumptions are positive attitude, commitment and motivation from lecturers; sound instructional design practice and sound teaching and learning practice. Furthermore, there are various exogenous factors, that is, factors over which instructional designers have no control, for example class size, incentives for lecturers and

work loads of lecturers and students. Underlying assumptions and exogenous factors are excluded from Table 1 in order to provide a succinct overview, yet they are of no lesser importance (see Fresen (2004) for more details on the underlying assumptions and exogenous factors).

Part III: Online student feedback survey

The importance and relevance of soliciting student (client) responses to learning situations is well documented in the literature (Clark, 2000; Leckey & Neill, 2001;Ramsden, 1991). It is an integral part of both the formative and summative evaluation of any learning intervention and is Level 1(participant reactions) in the four level evaluation model of Kirkpatrick (1998).

According to Clark (2000), there are two levels of student evaluation that yield the most useful results – participant reactions and the achievement of programme objectives. These two levels can roughly be equated with Kirkpatrick's (1998) Levels 1 (participant reactions) and 2 (actual learning). Both authors remark that the former is easier to collect, but should not serve as the *only* level of evaluation.

The issue of *actual learning* taking place reflects a dilemma that the team in this case study had to come to terms with. Are we as e-learning practitioners expected to evaluate whether learning outcomes were achieved by the student, or is that the domain of the lecturer? It is recommended that the evaluation of web-supported courses in terms of achievement of learning outcomes (that is, actual learning taking place) be a joint exercise between all the role players, using summative evaluation procedures. Such an exercise provides scope for further research and is not reported here.

The field of student feedback was researched and a student evaluation questionnaire for web-supported learning was developed. Ideas and an item or two were modified from Hannafin & Peck (1988) and Ramsden's (1991) Course Experience Questionnaire (CEQ). Hannafin and Peck (1988) present four 'adequacies' for evaluating computer-assisted learning: curriculum adequacy, programme (or technical) adequacy, instructional adequacy and cosmetic adequacy. The CEQ is officially used by all higher education institutions in Australia, as an indicator of the quality of teaching in *contact* learning programmes (Lawless & Richardson, 2002). Since then, Lawless and Richardson (2002) adapted the CEQ for *distance education* and Richardson (2003) adapted it for *web-based courses*.

The WebCT student feedback questionnaire in this case study is based on the following categories:

- personal information (4 items);

- technical adequacy and technical support (11 items);
- educational support (supportive resources and training) (2 items);
- affective domain (feelings and emotions of students) (4 items);

- interactivity (use of communication tools) (2 items);
- perceived learning (4 items).

Items within each category were measured on a 5-point Lickert scale ranging from 'Strongly Disagree', to 'Strongly Agree', with a central neutral option. In order to calculate metrics to measure client satisfaction with web-supported learning, satisfaction and frustration indices were computed (see Figures 4 and 5). Items in the questionnaire were classified as indicators of either satisfaction or frustration. It emerged that in general, items in the categories technical adequacy, educational support and the affective domain reflected student *frustration* and items in the categories interactivity and perceived learning reflected student *satisfaction*. Therefore responses were summed per respondent across the relevant categories to produce frustration and satisfaction indices respectively.

The survey is administered twice a year, at the end of each semester, namely July and December. The findings from July 2003 are reported here: the number of respondents was 4 651 out of a total of approximately 17 000 students with WebCT modules, representing a response rate of 27.4%. The metrics calculated in July 2003 form base-line data, which will inform longitudinal studies from semester to semester and from year to year, with the intention of monitoring continuous improvement.

The survey was programmed in a shareware software package and implemented on Student Online Services, the campus-wide portal from where students access their web-supported courses. Student registration numbers are recorded, although confidentiality is assured. The sample may be described as a self-selecting sample, since completion of the survey is a voluntary activity. This introduces an element of bias, in that only certain types of students may have elected to complete the questionnaire. However, being a client perceptions survey, a representative random sample from which to make inferences regarding the entire student population is not required.

The findings for the Frustration Index are shown in Figure 4. The percentage of respondents is on the vertical axis and reflected as a percentage on each bar. The levels of the frustration index were clustered according to the categories Low, Moderate and High. These are shown on the horizontal axis.

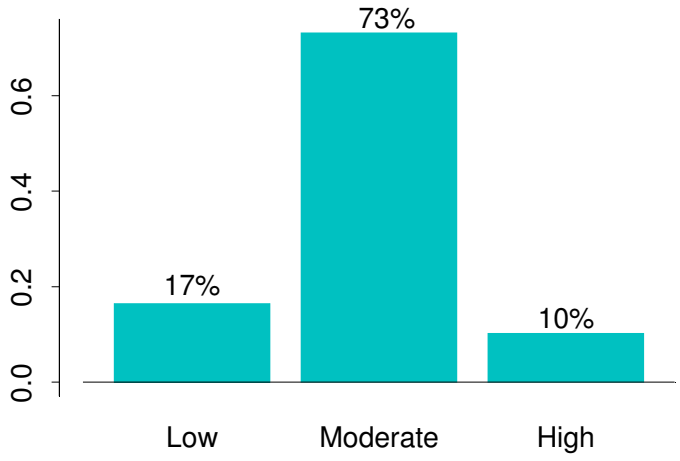

Figure 4: Levels of the Frustration Index

The **Frustration Index** shown in Figure 4 indicates that 83% of respondents experienced moderate to high levels of frustration in their web-supported courses. This statistic is rather high – efforts will need to concentrate on reducing levels of student frustration.

The Frustration Index was investigated in further detail to ascertain the contributing factors, which were as follows:

- insufficient computers available on campus;
- insufficient printing facilities available on campus;
- extent of technical difficulties experienced;
- insufficient support from the student CD-Rom;
- inadequate student training in WebCT;
- an impersonal learning experience;
- slow response from classmates;
- feelings of annoyance and/or stress.

The above contributing factors are discussed in further detail here, in order to identify areas for improvement. Several of the issues are already receiving attention. Priority is being given to the provision of more computers and printers both on campus and in student residences. The student support CD-Rom has been substantially redesigned and upgraded. It will be sold at cost price from the student bookshop, so that students who really need it will be able to obtain it easily and cheaply.

Table 2 shows that although a fairly high incidence of technical difficulties was reported, the majority (73%) of such difficulties were experienced less than once per week and 75% of difficulties were solved within 24 hours. The most common technical difficulties experienced were slow Internet access and the university server being down (or perceived so by students, who may not have been sure of the cause of the problem).

Table 2: Reliability of technology and technological support

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)

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)

How long did it take for technical problems to be solved?

Half a day	50.0%	(2327)
24 hours	25.4%	(1183)
2 - 6 days	10.5%	(489)
1 week or longer	3.9%	(183)
Never solved	10.1%	(468)

Student orientation sessions in the use of WebCT are offered regularly. However, 64% of respondents reported that the session did not equip them adequately to participate in their web-supported courses. Clearly the orientation sessions need to be re-designed in order to provide hands-on practice and experience in using WebCT.

Although 40% of respondents agreed that web-supported learning is an impersonal learning experience, almost as many (35%) disagreed with that statement. Given the fact that contact sessions are offered, this finding provides lecturers with information about the need for meaningful learning facilitation, interaction and feedback in the web-supported environment.

The item about slow response from classmates also attracted almost equal responses to the 'Agree' and 'Disagree' options (24% and 25% respectively), with 51% of respondents reporting that they were uncertain. In future administrations of the questionnaire, the neutral option will be removed from all items in order to force respondents to discriminate between agreement and disagreement. With respect to feelings of annoyance and/or stress, 31% of respondents reported agreement, and 38% reported disagreement. A positive result was that 66% of respondents found 'anywhere, anytime' learning to be convenient.

The findings for the **Satisfaction Index** are shown in Figure 5. The percentage of respondents is on the vertical axis and reflected as a percentage on each bar. As with the frustration index, the levels of the satisfaction index were clustered according to the categories Low, Moderate and High. These are shown on the horizontal axis.

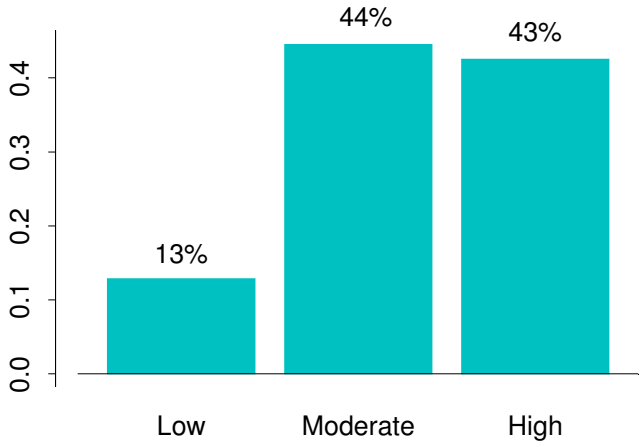

Figure 5: Categories for the Satisfaction Index

It can be seen from Figure 5 that 87% of respondents experienced moderate to high levels of satisfaction in their web-supported courses. Future efforts at continuous improvement should aim to increase the proportion of students experiencing high levels of satisfaction.

The following factors contributed to the Satisfaction Index:

- feeling comfortable communicating via online tools;
- feeling more freedom to express oneself than in a traditional classroom;
- learning from the contributions of other students;
- promoting one's ability to work as a team or group member;
- promoting one's ability to plan one's own work;
- experiencing an enriching learning environment.

The above contributing factors are discussed in further detail here, in order to produce management information with respect to client satisfaction.

One of the strongest benefits of web-supported learning is the facility for computer-mediated communication, debates and other such 'conversational' interactions (Carmichael, 2001; Wu, Lai & Lee, 2001). Table 3 reflects various aspects of online communication which students experienced in a positive way, especially if one sums the results for 'Agree' and 'Strongly Agree'.

Table 3: Communication with fellow students

I felt comfortable communicating via online communication tools.

Strongly disagree	4.9%	(227)
Disagree	7.8%	(362)
Agree	47.7%	(2217)
Strongly agree	14.6%	(678)
I don't know / Not applicable	25.1%	(1166)

Web-supported communication helped me to express myself more than I would have in a traditional classroom.

Strongly disagree	6.1%	(282)
Disagree	19.1%	(890)
Agree	36.5%	(1698)
Strongly agree	5.6%	(262)
I don't know / Not applicable	32.6%	(1518)

I learnt from the contributions made by other students.

Strongly disagree	4.5%	(211)
Disagree	10.5%	(487)
Agree	42.1%	(1957)
Strongly agree	6.6%	(305)
I don't know / Not applicable	36.3%	(1690)

Table 3 shows that students felt comfortable communicating online and found the interactive communication tools enhanced the learning experience.

Thirty nine percent (39%) of respondents reported that web-supported learning developed their abilities to work as a team or group member, although 38% were uncertain about this statement. More than half the respondents (54%) found that the self-directed nature of web-supported learning assisted them with time management in the sense that they developed an ability to plan their own work and to take responsibility for their own learning.

An encouraging finding was that 58% of respondents found web-supported learning to be an enriching learning experience. If the neutral option is removed in future as recommended, many of the findings reported here may provide stronger evidence of client satisfaction.

Many of the responses describing positive aspects of web-supported learning highlighted the importance of lecturer commitment and involvement, as seen from the sample of student comments given below.

> "Discussions with the lecturers and students."
> "Contact with lecturers improved."
> "Communication with lecturers is made easy."
> "Can contact lecturers online."
> "The online web has a great impact towards our learning."
> "I learned to communicate more to the point and concise."
> "It helped me to interact with my fellow student mates and lecturers."
> "Learning is best communicating with other people."
> "Long distance interaction between lecturer and students."
> "Lecturer's and fellow students' contributions."

Arbaugh (2000) refers to the fact that prior studies of internet-based courses have been criticised for focusing on individual courses. This study constructed and calculated both a

satisfaction index and a frustration index across a campus-wide spectrum of students participating in web-supported courses.

Quality Measurements

Measurements, such as the client satisfaction survey reported above, are an important part of ensuring and assessing quality, but they are only tools forming part of any management system. *"The tools of Total Quality Management are designed to help teams within an organization think more critically about the problems they face and the practices in which they daily engage"* (Murgatroyd & Morgan, 1993. p. 156). The emphasis is on being able to provide management information that will reflect the impact and return on investment produced by an intervention such as e-learning.

Murgatroyd and Morgan go on to clarify further the purpose of measurements:

> *"They are thinking clarification tools that are intended to aid the task of daily management by:*
>
> *i.* *systematically examining what is happening in the organization*
> *ii.* *standardizing 'best' practice within the work of the team*
> *iii.* *pointing out the possibilities for continuous improvement by facilitating the systematic scrutiny of practice within a team*
> *iv.* *recording progress towards the achievement of measurable goals*
> v. *minimizing the personality basis for debate and argument in teams and maximizing the data-based quality of the arguments."* (p. 156)

Lowe and Hall (1999) distinguish between a quality *process* and a quality *product*. They differentiate between *process measurement* and *product measurement*. On both 'counts', they state that few, if any, widely accepted metrics yet exist. The expansion of both the student and lecturer satisfaction surveys, and identification of a selection of product and process measures to substantiate meaningful continuous improvement, provide considerable scope for further research in this project.

Summary and conclusions

This paper presented a case study which implemented a holistic, formal, online quality management system in the E-Education Unit at the University of Pretoria, South Africa. The formal QMS has yet to be empirically tested (i.e. summatively evaluated) to ascertain if the quality of web-supported learning has been improved and to what extent. What is clear, is that the exercise of applying standard QA theory to the instructional design process proved to be a valuable self-evaluation experience. Each of the *procedures* in the Project Timeline (the instructional design *process* – see Figure 3) was brainstormed, formalised, streamlined and documented. This caused team members to critically evaluate what they were doing, why they were doing it, what value was being added and how outputs are recorded, used and stored.

The online QMS ensures that team members have easy access to current versions of all the procedures and supporting documents. A further benefit is that new team members, student

assistants and visitors have an immediate overview of the instructional design practice in the Unit.

The quality of web-supported courses may be enhanced by applying the framework of critical success factors for web-supported learning. The framework (Table 1) was synthesised from well-known studies in the literature. Fresen (2004) used critical colleagues within the case study to refine, validate and corroborate the framework, but it too, has yet to be empirically tested.

The intended means by which the online QMS and the framework of critical success factors should improve the quality of web-supported learning, is for them to be used in conjunction with *measurements* to inform the cycle of continuous improvement and to provide management information. Measurements currently take the form of quantitative and qualitative client satisfaction feedback, either as the result of surveys, or during personal interaction in web-based course demonstrations, QA sign-off sessions and project review meetings.

It is recommended that the summative evaluation procedure generated as part of the QMS should be implemented as a joint exercise between all role players. This will enable the team to assess not only the benefits of web-supported learning and its impact on the achievement of learning outcomes, but also responsibilities, extent and 'fixability' of identified problem areas. After some experience has been built up in analysing longitudinal client feedback data over time, it will be necessary to identify a small number of critical aspects on which improvement efforts can best be concentrated.

By providing credible management information, measurements help to quantify the value contributed by the E-Education Unit in the form of support and services offered to lecturers and students. In so doing, this may justify, in a small 'measure', the return on investment made by the management of the University in their vision for education innovation.

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