3 Literature review: Theory into practice

3.1 Introduction

Chapter Two provides an adequate description of various theories that are relevant to use in the investigation of *process*, *product* and *service* innovation of the virtual campus. This Chapter serves the purpose of contextualising the case in Chapter Four. It also serves the purpose of demonstrating best practice. All theories in Chapter Two manifest in the current higher education landscape that is described in this Chapter. Figure 3.1 illustrates how Chapter Three fits into the structure of this thesis.

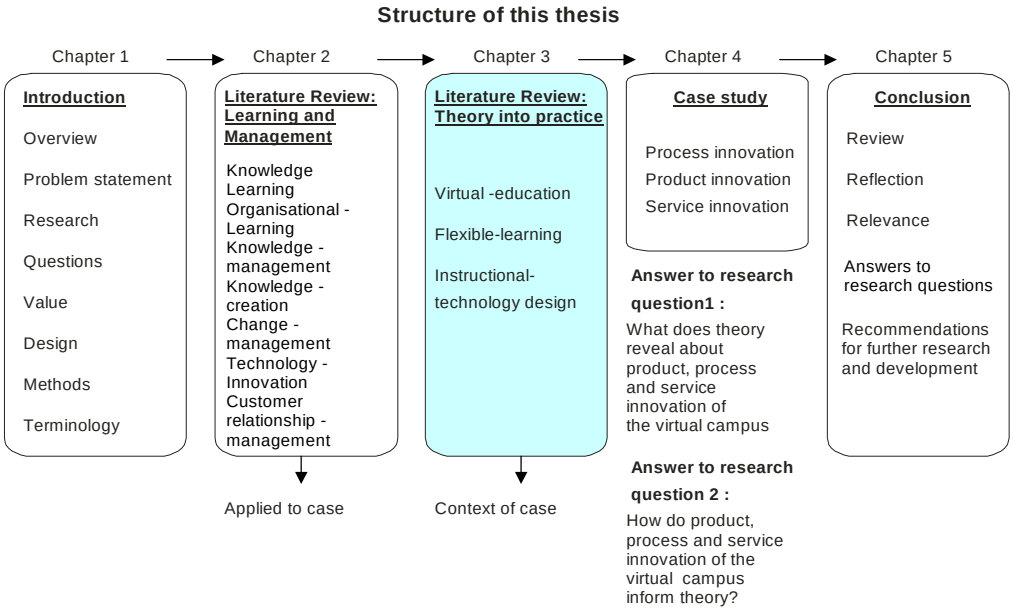

Figure 3.1 Structure of this thesis

Some theorists postulate that the innovative kinds of teaching and learning empowered by emerging technologies could transform distance education into distributed learning. They further claim that high-performance computing and communications will make knowledge utilities, virtual communities, shared synthetic environments and sensory immersion commonplace (Drucker, 1985, Dede, 1997).

Traditionally in the business of information transfer and knowledge creation, many higher education institutions are no longer competing with one another. One reason is that the market has changed from school leavers to adults. Businesses and large corporations are competing for students by offering in-service training and short

courses. Drucker's (1985) prediction that "the growth industry in this country [USA] and the world will soon be continuing education of adults" is coming to pass. The forecast is that higher education will become market driven as it deregulates. In the USA it is predicted to be as big as a $300 billion industry in the next decade, featuring 30 million learners of which 50% will be adult learners who are active in the work force (Duderstadt, 1999:11). Svetcov (2000:50) mentions a forecast by Thomas Weisel Partners (a merchant bank in San Francisco) of $21 billion in the next three years. The analysts estimate a $10 billion virtual higher education market and a $11 billion corporate-learning market. Although no similar data exists for South Africa, it is an important trend to take note of.

Business, more than government, is instituting the changes in education that are required for the emerging knowledge-based economy. The reason is provided by Cairncross (1997:118), who states "the Internet has become the most powerful driver for innovation that the world has ever seen. Because of its open, flexible protocol, thousands of small companies, founded by the best-educated group of entrepreneurs ever to blitz a business, are making (or, periodically, losing) huge sums of money developing new ways of using the Internet". Especially public providers of education are lagging behind the transformation in learning that is evolving outside them (Ives & Jarvenpaa, 1996, Gates, 1996, Violino, 1997:70). According to these authors, over the next few decades the private sector could eclipse the public sector as the predominant educational institution. Businesses are moving into the educational market, especially in commerce and information technology by offering life-long in–service training to employees, thereby capturing a market segment previously held by higher education institutions. In addition, massification of education and the shift in education and training to lifelong learning demand different approaches to teaching and learning from what is found in traditional universities. In-house programs provide tailored instruction at times and places convenient to the customer. Businesses have adopted customer-oriented strategies whereas educational institutions do not yet regard students as customers or clients.

Subsequently, the challenge posed to educational institutions is to manage technology and knowledge in such a way that their strategic goals are achieved but that they satisfy the customer at the same time.

In a survey on Desktop Computing and Information Technology in American Higher Education, Green (2000:2) identifies instructional integration as a core concern facing

American colleges and universities. Green remarks that the results confirm the transition of information technology from the unique to the ubiquitous and that increasingly there will be a demand for technology innovation in American higher education. Due to the global impact of technology on society as a whole, the same could be said of all higher education institutions around the world.

Section 3.2 explores the emerging field of virtual education.

3.2 Virtual education

Over the past five years the term 'virtual' has proliferated to describe the range of technologies applied in higher education institutions. It is used interchangeably with other labels such as 'open and distance learning', 'resource-based learning', 'distributed learning', 'distance education' and 'flexible learning'. Currently, the term most used is 'electronic' as is evident in the concepts of e-education, e-commerce, e-business and e-governance. Similarly the term 'digital' is increasingly popular in this context.

Collis and Moonen (2001:32-33) have a specific view of the term 'virtual':

- "Virtual as a vision that anyone, anywhere, can experience the services and products of the university, while remaining at home or at work".
- "Virtual as a way of describing how the traditional university can gradually move to be more flexible in the options it offers to students in terms of how, when and where they complete certain course requirements".
- "Virtual as a way of describing how the resources and experiences available within the traditional university are being broadened for those within the university".
- "Virtual as a way to describe consortia".
- "Virtual in terms of a specific informational environment, such as portals, by which learners interact in a virtual learning environment".

Duderstadt notes that the increasingly sophisticated labour market of a knowledge-driven economy is driving new needs for advanced education and training (2000:14).

It could safely be assumed that hundreds of virtual universities have emerged and that these numbers continue to grow.

Section 3.2.1 describes the reasons why new services and products are required in the higher education sector.

3.2.1 Product innovation

In the borderless competitive environment that is discussed in the introduction, the attainment of a competitive advantage will be appropriated through *price*, *quality* and *access* of *services* and *products* (Duderstadt, 1999:12). Consequently, new rules are set for the way we do business. It is fundamentally changing many of the rules of competitiveness. Organisations that are positioned to rapidly act and respond to changes will have the competitive advantage. This is endorsed by Nadler and Tushman (1999:97) in their contention that "the organisation's capacity to understand its environment and to make the right kinds of strategic changes at the appropriate point in the cycle will determine its competitive strength".

Leadbeater (2000:112) claims "In some respects universities are models for the new economy, particularly the way they encourage research, experimentation and knowledge-creation by autonomous, self- managing researchers and knowledge workers". He warns though that universities lack entrepreneurial spirit and are "too slow-moving and resistant to change". Slow to change, universities have revolved around a model born in the Middle Ages and solidified by the German research university concept at the turn of the century (Hitch, 2000:21).

With the emergence of a commodity market, virtual universities will unbundle marketing and delivery of services and customised products to users. The most common applications of ICT are found in administration, support services and materials development and distribution (Farrell, 1999:3).

The move to digital technologies has given rise to new learning enterprises. Barone and Luker (2000:10) note that familiar business models in universities will no longer apply as the roles of producer and consumer shift and evolve. Especially the private sector is capitalising on the technology revolution. An example is the company-

owned British Aerospace Virtual University, which has 47 000 students (employees) who access courses offered by the University (Gibbons, 1998:49).

However, the crucial role of universities remains that of the interface with learners in the learning process. Although universities are becoming more like businesses, they are not simply selling products, but have to be the leaders in learning facilitation.

Traditional structures, processes, teaching and research methodologies, financial formulas and subsidies at universities have been moulded by paper for centuries. Digital technology has vastly different properties that do not fit into the status quo (Battin & Hawkins, 1998). These properties include availability on-demand and customisable, borderless and ubiquitous information that are contrary to the stability of print-on-paper technology. The geographical distribution of information around the world is being shifted in response to demand for access and the Internet is powerful enough to serve teaching, research and administration needs (Barone & Luker, 2000:6).

Especially telephone and Internet technologies have grown exponentially and are impacting on higher education. Projections were made that the global Internet user population will exceed 140 million by 2001 (McNee, 1999:3).

Dede (1990:247) makes the point that “Given the rapidly evolving implementation of information technologies, all students will need skills in online interaction and collaboration”. Twigg & Oblinger (1996:3) support this by stating that proficiency in using technology is a required competency in the work place. The implication is that higher education institutions need to equip their learners with computer skills because they need these to be competitive in the market place.

A poignant statement is made by Norman and Spohrer (1996:24):

“A revolution is taking place in education, one that deals with the philosophy of how one teaches, of the relationship between teacher and student, of the way in which a classroom is structured, and the nature of the curriculum. At the heart is a powerful pedagogy, one that’s been developing over the past 100 years. It embraces social issues, the culture of the classroom, lifelong learning concerns, and technology”.

This trend suggests a shift in the primary location of higher education on campus to more flexible, learner-selected options such as home and the work place. A way to accomplish this is through product innovation, i.e. to redesign courses and use technology.

According to Green (2001:36) “the most significant technology challenges ahead for higher education involve questions about the instructional mission – across all sectors of the academic enterprise”. In other words, universities have to consider how they need to change their product offering in order to remain competitive.

The response of learners to these changes should be accounted for. They are accustomed to a passive role in which lecturers are paid to teach. In reaction to the use of digital technology in the learning environment, Barone and Luker (2000:10) remark that “students wonder if faculty are really teaching them if most of their learning appears to take place independently, from learningware accessed via the network”. The concern about this statement is the tendency to provide syllabi and content online without an accompanying strategy to facilitate learning.

With the use of computer communication systems for educational delivery and interaction, web-based education is growing rapidly as a field of practice. Driscoll (1998:9) warns that web-based instruction is not simply a new format for instructor-led or self-paced instruction and that merely ‘changing the format’ tends to result in passive programmes that frustrate learners.

A critical challenge to universities will be to identify their role in disintermediation – information technology sometimes replaces the ‘middle man’ – and to identify “those ‘transactions’ where humans are ‘in the middle’ as opposed to those in which they add value” (Oblinger, 1999:24). This is reminiscent of the factor of **cost of producer learning** mentioned earlier. In an educational context it means that lecturers would need to add value to the learning process and not simply act as yet another source of knowledge or information. The way in which they facilitate the learning process, doing so increasingly via various technologies; will aid competitiveness. As a consequence of the impact of technology, the new role of the lecturer has become a concern.

Leadbeater (2000:113) contends that universities and academics will become increasingly segmented. The elite will be involved in the ‘knowledge- creation'

business of research and experimentation; the mass will be involved in the 'knowledge management' business of delivering degree modules. He does not indicate the way in which this will be accomplished. As technology has become a primary means of delivery, it implies that the latter segment of lecturers would have to be skilled in the use of various technologies to facilitate learning. It could be debated whether these roles would be simply value-adding transactions or whether the lecturer-student interaction could be considered as that of being 'in the middle'. Duderstadt (1999:9) indicates that an emerging trend is that of three roles of what was previously packaged into one: that of the lecturer. These roles are *content providers*, *celebrities* and *learning facilitators*. He argues that constraints will make it impossible for one person to fulfil all these roles and remain competent in other responsibilities such as research and administration. Oblinger (1999:24) speaks of the 'unbundling' of traditional tasks. A lecturer might choose which functions to perform, based on aptitude or on those functions in highest demand by the university. Hence she postulates that the current value chain of content generation, courseware production, assessment and research could be dispersed among various individuals or even companies or different institutions. Although it seems to be a feasible solution, successful orchestration of the value chain across functional providers would pose the highest risk. If coordination is not adequate, the learner will experience a fragmented service offering.

Section 3.2.2 investigates service innovation in higher education.

3.2.2 Service innovation

Disintermediation has a profound impact on existing structures. Distant learners assume that payment and registration can occur online and that online digital library privileges exist. There are many examples of universities that have web-enabled student administration systems to deal with student enquiries. Some higher education institutions are finding that almost sixty percent of student enquiries related to student services can be handled without human intervention (Twigg & Oblinger, 1996:4). Most universities have not redesigned their business processes to suit the needs of students. Unfortunately administrative functions such as admissions, financial aid, and registration processes are mostly set up for the convenience of the institution, with minimal regard for the needs of the consumer (Twigg & Oblinger, 1996:4).

With the advent of Enterprise Resource Planning (*ERP*) systems in the 1990's some higher education institutions have shifted to integration of business processes. Since 2000, *ERP* systems have become increasingly Internet-based – thereby enabling a more customer-focused strategy by giving students and staff access to enterprise information via the web. These systems include modules such as student administration (admissions, recruiting, student financial aid, student records and payment), human resources and supply chain management. *ERP* systems could be regarded as *service* innovation, because it is an example of technology innovation where the institutional service offering is integrated on a large scale in such a manner that it also benefits the customer, i.e. the student. The shift towards web-enablement and subsequently self-service is consumer centred and a positive step towards a competitive business model.

Two of the *ERP* market leaders, namely Systems and Computer Technologies Corp. (*SCT*) and *Peoplesoft* have been adopted by 1300 and 610 campuses in the U.S.A. respectively (Yanosky, *et al*., 2002a & 2002b: 1-4). Figure 3.2 gives an overview of the various *ERP* systems in higher education in the U.S.A.

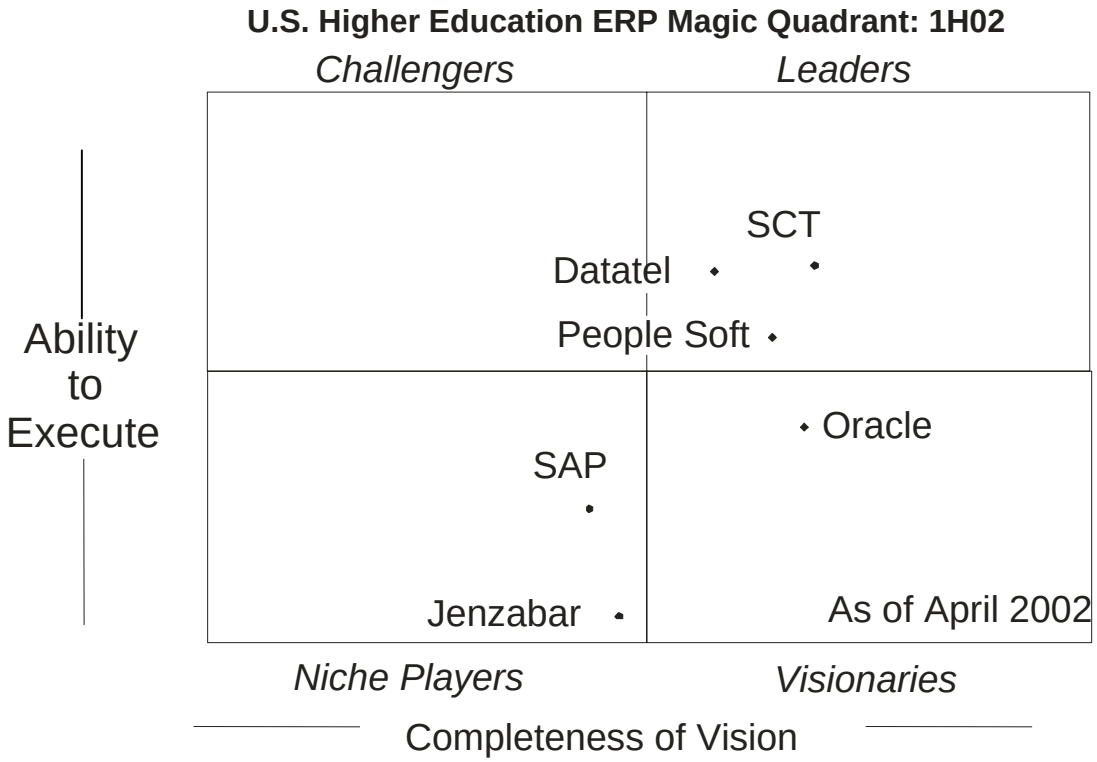

Figure 3.2 U.S. Higher education *ERP* magic quadrant (Yanosky *et al*., 2002c:1)

ERP systems are costly and have not yet penetrated the South African higher education market.

Similar to *ERP* systems that integrate and make information accessible to more users, virtual libraries are imperative to act, in a certain sense, like brokers of relevant information sources that form a critical part of knowledge – particularly regarding research.

Section 3.2.3 discusses the need for a new business model in higher education.

3.2.3 A new management model: Process innovation

As a result of rapid changes in technology and the explosion of information and knowledge, employees require re-skilling more often. According to Twigg and Oblinger (1996:3) the average worker can have up to seven careers. Consequently, lifelong learners make greater demands in terms of educational access and flexibility. Most cannot afford to leave their jobs for lengthy periods in order to further their qualifications. Moreover, school leavers increasingly opt to find work first and then further their qualifications whilst working. Many underestimate the rise in expectations that working students bring with them. As paying clients they are no longer in awe of professors or of rigid structures and processes that do not provide excellent service. They expect quality products and services. Policy makers are concerned whether the salaries spent on duplicative administrative and student services add value to the educational experience (Twigg & Oblinger, 1996:8). Hence higher education institutions need to adapt their processes to support and sustain new products and services.

Adults are exposed to a rapidly changing and complex work environment in which they have to be re-skilled continuously. Without the time available to study full-time at a residential university, flexible learning opportunities have become non-negotiable. Increasing costs, decreasing public funding and a growing population, half of which are adults from diverse socio-economic backgrounds, are causing an increasing market niche for just-in time and just for you (non degree continuing education) instructional offerings. Yet students continue to attach value to formal programme offerings, such as three-year degrees. Perceptions of status and quality

associated with degree programmes could be the reason why many still consider short courses to be of less value.

Duderstadt (1999:4) states "Adult learners look for access, customised curricula, flexible delivery and responsiveness to needs". The growing demand for flexible education and training cannot be met by existing management models. Johnson (1997) poses that traditional universities will continue to cater for highly motivated, academic learners, with emphasis on advanced research. Alternative institutions, on the other hand, will focus on non-university, corporate and continuing forms of higher education. Yet, even if this is the case, traditional universities cannot afford to ignore the impact of the knowledge economy, digital technology and the needs of their learners. Teaching and learning models of the future assume universal access to the network (Internet) and will require a new pedagogy (Barone and Luker, 2000:6). New business processes will be required to enable and support this.

Education and advances in technology have become at least as important as capital in contributing to economic growth (Cole, 1998:16). The nature and degree of exposure of employees to lifelong learning and education has led to the term 'knowledge workers'. Academic institutions have essential roles to play in the knowledge economy to serve as sources of knowledge creation and as training ground for knowledge workers (Cohen, 1998:37). Graduates are viewed as the most important asset of universities and concomitantly, a research environment that retains faculty is essential.

Questions about accreditation, standards, intellectual property and articulation have remained mostly unanswered to date and need to be answered to adapt to the new environment. Stallings (2000:3) paints a scenario called 'Dystopian' in which this confusion leads to a quagmire of courses and courses without human presence in which, in the absence of standards and leadership, a dominant model emerges from a body of accredited learning corporations. The researcher is of the opinion that continued regulation of higher education institutions will prevent this scenario from materialising. It will be more difficult to prescribe standards to private providers. The South African Qualifications Authority (SAQA) is an example of a regulating body that attempts to regulate all providers of education and training. The 'Utopian' scenario, similar to the Edujazz scenario by Page-Shipp *et al*. (2000) sees a growth industry of "performance-enhanced software [that] energises a generation of virtual educators and trainers who become globally recognised… Computer-based instruction

increasingly applies artificial intelligence techniques, driving the quality of instructor-mediated courses higher".

According to Twigg and Oblinger (1996:9) a scenario for higher education institutions in 2007 could be characterised by the following:

- Fewer institutions.
- Flexible learning opportunities.
- More for-profit educational enterprises.
- Greater global institutional competition.
- Provision of credit banks and credentialing services by public learning agencies (accreditation bodies).
- Institutions positioned as either content providers or learning brokers.

They state that many companies in the States are dissatisfied with the level of competence of the nation's graduates and that "they are becoming less interested in degrees and more interested in certification of competencies" (Twigg & Oblinger, 1996:10).

In the debate about how higher education must position itself to respond to the needs of 21st century learners, two distinct points dominate:

Pro-traditional higher education

This side argues that there is more to education than providing job-related skills. Unlike training providers, universities also provide guidance, structure and organisation for those students who are uncertain about what they need. This view is contentious, as technical and college institutions could claim to do the same.

Non-traditional higher education

Others contend that education rooted in tradition has become less relevant. External forces, including student needs, market demands and the advancement of communications technologies have decreased the 18-22 year old residential student market. Just-in-time education will become sought after.
Duderstadt (2000:17) points out that only 17 percent of students enrolled in American colleges are in the 18-22 year old group.

Yet Zastrocky (2000) warns against inflated perceptions of the benefit of virtual education, or as he calls it, *distributed learning*. He makes a forecast of the evolution of the Internet's path to maturity in higher education that is depicted in Figure 3.3.

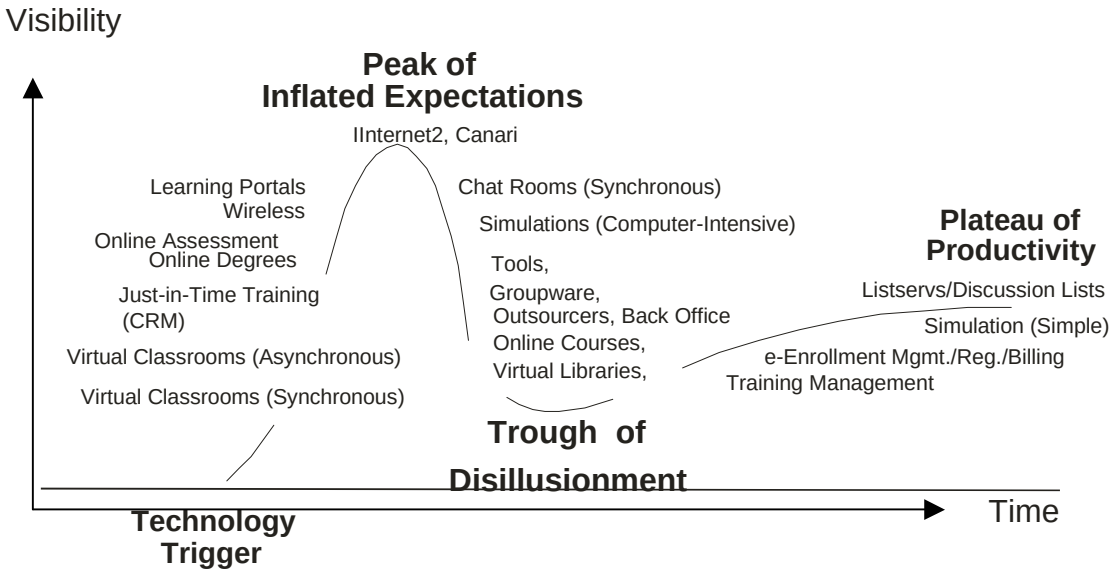

Figure 3.3 Distributed learning hype cycle for higher education (Zastrocky, 2000:3)

What is clear from Figure 3.3 is that the Internet will remain relevant to higher education despite inflated expectations.

In Section 3.3 the concept of *flexible learning* is discussed.

3.3 Flexible learning: process, product and service innovation

The use of technology in education has been prevalent since the sixties and has been utilised in especially distance education for decades.

Taylor, as cited by McLendon & Cronk (1999:1-2), outlines four generations of distance education delivery, as indicated in Table 3.1.

Generation	Associated delivery technology
I. Correspondence model	Print
II. Multimedia model	Print, audiotape, videotape, computer-based learning, interactive video.
III. Telelearning model	Audio teleconferencing, videoconferencing, audiographic communication, broadcast TV/radio and audio teleconferencing.
IV. Flexible learning model	Interactive multimedia, Internet-based access to *WW W* resources, computer mediated communication.

Table 3.1: Four generations of distance education delivery (McLendon & Cronk, 1999:2)

Distance education is a greatly misunderstood area in the field of education (Roy, 1997:12). If distance learning is a concept so widely misconstrued, how much more so the concept of open learning or, for that matter, flexible learning. Distance education is often thought of as correspondence education. In many countries the terms are used interchangeably, i.e. distributed learning, blended learning, flexible learning, e-learning, online learning and distance learning. Distance education has been described as teaching and learning through the print or electronic communications media, in a place or time different from that of the facilitator/lecturer (Moore & Kearsley, 1996). This would therefore dispel the myth that distance education is education by correspondence per se. A brief review of its growth shows that distance education has evolved through a number of different stages, or generations and could be considered to be an example of incremental innovation. The first generation was correspondence study, where printed media in the form of study guides was sent by mail to students. The addition of tape recordings further enhanced it (Roy, 1997:12).

The founding of the British Open University (OU) in 1969 and other Open Universities in the early 1970s heralded the second generation of distance education (Moore & Kearsley, 1996). Now, in the 1990s, some 30 distance teaching universities are active in various parts of the world and most of them have been modelled after the OU. Whilst adopting a Fordist or large-scale approach, these open universities rely heavily on correspondence instruction and concurrently use broadcast and recorded media, especially programmes distributed by radio, television and audio tapes as supportive media. This approach set the pace for the transmission to the third generation, as suggested by Bates (1995). He proposed that

a new model is emerging, based on key elements of interactive communication (via asynchronous computer conferencing) and the learning process. The delivery of course materials by broadcast television videotape, with interaction by telephone, or both delivery and interaction by telephone or satellite, cable or ISDN (Integrated Service Digital Network) lines, characterises this stage of development.

Developments in distance education in the 20th century appear to have taken a two-pronged approach. On the one hand, the advent of information technology and modem media has enabled mass-production or a large-scale approach to be adopted. Open universities, based on the OU model, often produce courses for hundreds and thousands of learners, using just a few tutors. In the single-mode system, distance education is the sole approach to the teaching-learning function. Essentially, open learning refers to the democratisation of education. It does not recognise race, religion, gender, age or prior qualifications and opens the doors to learning. Since everyone has a right to education, open learning was deemed the vehicle to ensure this, unlike many other forms of conventional teaching-learning models (Moore, 1997). Open learning also refers to provisions which try to remove barriers that prevent attendance at more traditional courses and which suggest a learner-centred philosophy. Proponents of open learning seek to empower learners by breaking down barriers to education raised by conventional institutions. They wish to provide unhindered access to learning resources so that technologically supported freedom of information may be turned into freedom of education for people pursuing their own learning needs (Brown & Duguid, 1996:12).

In a document submitted to the National Commission of Higher Education (Committee of Technikon Principals, 1995), which includes a section on “Mode of Instruction”, the idea of “fleximodes” of instruction is recommended.

Collis and Moonen (2001:9) attempt to describe the notion of flexible learning as follows:

“Flexibility can involve options in course resources, in types of learning activities, in media to support learning, and many other possibilities”.

Hedberg and Corrent-Agostinho (2000) define it as “providing students with choices about when, where and how to study”.

Another definition is provided by Fleming & Levie (1993):

“Flexible learning offers the learner a more actively constructive role by providing a framework in which learning goals can be more independently pursued”.

Jonassen *et al.* (1997) add that a flexible learning strategy increases the quality of learning experiences and complements constructivism.

Hart (2000) highlights the economic driver of flexible learning, citing Nunan (1996):

“While part of the framework for flexible delivery may be borrowed from economics, there are progressive interpretations of flexible learning which are structured around competing social and humanist values which have educational expression through concepts such as constructivism, open education, student centred learning, life-long learning, deep learning and accessible learning structures”.

Hence, flexible learning means that the learner is given more control over the time engaged with learning resources and a wider selection of resources, including various technology modes. It could also impact on an institution’s accreditation and entrance requirement policies.

Collis and Moonen (2002:15) point out that more flexibility requires more self-direction, self-motivation and choices by the learner. As indicated in the first section though, many learners would rather have the lecturer make the choices, because they do not feel comfortable to do it themselves.

The authors list the following constraints of flexible learning:

- Flexibility is hard to manage because of limited resources and time of lecturers and the administrative load it creates.
- Flexibility is not acceptable for learners who are familiar with fixed course offerings.
- Flexibility is costly – various options do not allow for economy of scale.
- Flexibility is not achievable if it really boils down to learner choice.

In this light institutions have to find a balance that fits their culture, market and strategic focuses.

Market changes and diversifying demographics reflect the increasing need for lifelong learning. Krempl (1997) notes that the demand for tailor-made courses which contain only relevant content is becoming more prevalent. Relevant outcomes, more so than content, would probably be more suitable for a culture of lifelong learning.

The impact of adopting a flexible learning strategy is delineated by Hart (2000) in Table 3.2.

Principle	Impact
Flexible access – students can choose to work independently or to attend traditional classes and can determine where they enter and/or exit from the course.	Revise support to students, administrators will need to devise new means of accrediting and reporting on students, and lecturers would have to support different entry and exit levels and learning styles of a wide range of students.
Recognition of prior learning – a flexible learning policy takes account of prior formal and non-formal (work experience) learning in developing a suitable course of study for the learner.	Bridging and revision courses, as well as entry tests will need to be provided.
Flexible content – courses are modularized so that learners can take those they need or for which they have not established prior learning evidence. They can also negotiate the content of a course with university staff and employers.	It implies a set of university-wide agreed standards for course structure and credits and requires rigorous instructional design and a team approach to curriculum.
Flexible participation – lecturers are available to times convenient to the learners and communication can be synchronous or asynchronous.	No sign on the door of a lecturer saying “I am not available for consultation between the following hours”.
Flexible teaching and learning methods. The teaching style is based on the requirements of the subject and needs of the individual learner.	Lecturers need more theoretically grounded pedagogical knowledge as well as skills. Learning is individualized, collaboration is encouraged and metacognitive goals are pursued.
Flexible resources – access to a wide variety of resources are provided on and off campus via technology and other infrastructure.	The university must provide state of the art ICT on an equitable basis to ensure that all learners have equal access.
Flexible assessment – assessment needs to be based on competency.	Universities need to introduce alternative forms of assessment such as portfolios and collaborative presentations.
Ongoing education – flexible delivery involves the development, exchange, repackaging and cross-accreditation of modular courses and course elements in multiple media formats.	Evaluation strategies must be built into course designs and results of evaluations must be available to course developers and learners.

Table 3.2 Impact of flexible learning (Hart, 2000)

Some institutions, as indicated in Section 3.6, have ventured into a flexible learning system on a micro level, i.e. initiating specific instructional programmes on a flexible learning basis, whereas others have adopted it on an institutional level. In its totality, as indicated by Hart (2000), a comprehensive flexible learning model leads to *process*, *product* and *service* innovation.

Technology innovation plays an increasingly significant role in accomplishing greater flexibility. In Table 3.3, Ely and Minor (1994) provide the following essential components of technology planning at this level:

The field of educational technology	Definitions, conceptual background, theory, dissemination, organisations, policy.
Design functions	Resources, tools, models, procedures, techniques, evaluation.
Delivery options	Hard and soft technologies, telecommunications, media.
Applications and settings	Implementation, context, case studies, use.
Emerging issues	Legislation, cost-effectiveness, research findings, trends, futures.

Table 3.3: Technology planning (Ely and Minor, 1994)

Looking at the above framework, it appears to be a useful tool to apply to the overall planning and implementation of any technology. Schrum and Berenfeld (1997:53) recommend a systematic three-step implementation plan of technology into the educational system. Step one is to enhance the existing curricula with supplemental software packages and on-line activities. They note that "Even though the overall teaching strategy remains conventionally teacher and textbook centred, students with access to on-line resources are exposed to an array of information and confront conflicting opinions that require critical thinking" (1997:53). Another advantage is that both learners and lecturers become accustomed to various technologies as instructional tools, without having to redesign their existing curricula completely. The next step is to progress to technology-based modules and finally, to a situation in which technology is fully integrated into the curriculum. This implies, as the authors note, redefining of pedagogical goals and restructuring of curricular offerings. After conducting extensive evaluation studies, the University of Central Florida (UCF) found that students prefer a mixed mode in which some face-to-face contact time remains (Epper & Bates, 2001:8).

Section 3.4 discusses the design of learning environments that include technology – particularly the *WWW*.

3.4 Instructional technology design

Instructional design of learning environments started being applied on a large scale in the late 1950s and has been studied since the turn of the century. Instructional design is purported to augment learning by incorporating various strategies into courseware, for example structuring, ordering and sequencing content in particular ways, depending on the expected learning outcome (Gagné & Briggs, 1974). It is concerned with improving learning by applying various instructional strategies to the learning environment and could be considered to be an example of *product* innovation. In the early 1960s, researchers started to transfer this concept to electronic environments (Dempsey & Sales, 1993:7). Subsequently, mastery-learning programs with program control (which means the program determines what sequence the learner follows) developed over a period of almost four decades into more cognitive-based, flexible environments with more learner control. Real world educational technology research and development demands a shift in focus from the design of instruction to the design of learning environments (Kozma, 2000:13).

If learning is designed in an electronic environment, it firstly requires familiarity and understanding of the underlying models of the specific technology application, even before the analysis phase commences. This is necessary because different applications are used in different learning contexts.

Simulations are examples of single-purpose software. A simulation is a software application that represents certain features of a real situation to achieve a training objective (Dempsey & Sales, 1993:199). It is used to instruct by imitating or replicating reality; the learner learns through doing. The basic aim of the underlying model is to present a scenario in which an action is required and to update the system based on the feedback of the learner. Simulations have proven to be extremely effective tools for learning (Fleming & Levie, 1993). The development of high-performance simulations allows learners to control the simulation interactively, e.g. modify the laws of physics and study the effects immediately. An example is The Living Textbook Project: Interactive Learning on the Information Highway, which

delivers the results of virtual reality to illustrate tornado prediction models, financial modelling, real-time three-dimensional (3-D) interactive journeys through geographic terrain (Brown & Duguid, 1996:10).

A drill, on the other hand, is used to practise certain knowledge or skills already acquired. The learner learns through rote repetition until automaticity is achieved. In terms of the underlying model, an item is selected from a pool and the learner must respond to it (question and answer). The response is then judged, feedback is provided and another item, which the learner has not yet done or which was previously answered incorrectly, is selected (Alessi & Trollip, 1985).

The constructivist approach to instructional design moves away from direct instruction and systematic design procedures towards participative learning where knowledge is encountered in the context of real-world problems. Whereas the learning theories discussed in Section 2.3 are *descriptive* theories that describe how learning occurs, Section 3.4 covers *prescriptive* theories that set out procedures for developing instruction (Bruner, 1967).

3.4.1 Cognitive instructional technology design

The scope of this study does not allow an in - depth analysis of instructional design models and theories, but rather focuses on cognitive and constructivist design strategies. According to Winn (1990) behavioural roots remain evident in three areas:

- The reductionist premise that the parts of the whole must be identified, and if these are taught, then the whole has been learned.
- The practice of separating design from the actual implementation of instruction.
- The belief that, if design procedures are correctly applied, good instruction will result.

The general process involved in incorporating cognitive strategies in courseware (Smith & Ragan, 1993:94) is as follows:

- “Analyse the requirements of the learning task”.
- “Analyse the learners’ ability to complete the task, including the predictable demands on and limitations of memory”.
- “Select/invent an appropriate strategy” [such as a concept map or a flow chart].
- “Apply the selected strategy”.
- “Evaluate the effectiveness of the strategy used”.
- “Revise as required”.

Tracey (1992:242) provides the following instructional design guidelines:

- Initiate the sequence with materials that are familiar.
- Give learners a framework to use in organizing what they are to learn.
- Place easily learned tasks, broad concepts and technical terms that have application throughout the instructional process early in the sequence.
- Place practical application of concepts and principles close to the point of the initial discussion of the concepts and principles.
- Provide for practice and review of skills and knowledge that are essential parts of tasks to be introduced later in the activity.
- Introduce a concept or a skill in the task in which it is most frequently used.
- Structure learning objectives in closely related, self-contained groups.
- Avoid overloading any task with elements that are difficult to learn.
- Place complex or cumulative skills late in the sequence.
- Provide support for practice of required skills, concepts, and principles in areas where transfer is likely to occur.

West, Farmer and Wolff (1991) propose practical cognitive strategies to foster metacognition and facilitate active creation of mental schemata:

Chunking – rational ordering and classification of knowledge.
Frames – grids to structure concepts, categories, and relationships – either provided by the instructor or partially developed by learners themselves.
Concept maps – visual arrangements with links to represent relationships.
Advance organizers – brief prose introductions prior to new material.
Metaphor/Analogy/Simile – creative links to show similarity between known and new concepts.

Rehearsal – reviewing, asking questions, predicting – with learners playing an active role.
Imagery – mental visualization as a learning aid.
Mnemonics – artificial memory aids, for example, first letter coding.

Another way to foster metacognition is to create a learning environment in which learners interact with each other, as is the case in cooperative learning and constructivism.

3.4.2 Constructivist and open-ended technology design

To support the theory about ill-structured knowledge domains discussed in Section 2.3.10, Jensen (1995:5) contends that the brain is poorly designed for formal instruction and that most group instruction situations that have been tightly and logically planned will have been wrongly planned for most of the group. The result is that learning is ultimately inhibited, distorted or prevented.

Another interesting point is that the brain processes information on many paths, modalities, levels of consciousness and meaning levels (Jensen, 1995:12). Thus the brain prefers multi-processing and a linear pace could reduce understanding. It is therefore crucial to design instructional domains which are not oversimplified or reductionist, but designed in such a way that it simulates the real-world complexity and ill-structuredness of many knowledge domains.

The challenge posed to lecturers is to create a rich learning environment, which is situated in real-life, or which closely resembles real-life within which the learner can construct meaning (White, 1996:69). Opportunity to manipulate the learning environment is crucial, in fact, the more the learner can manipulate the environment, the better. Within an outcomes-based learning system, emphasis is placed on activity-based learning (cognitive apprenticeship) where opportunities are provided to learners to explore ideas and concepts and practise skills. Furthermore, co-operative as well as individual learning contexts should be provided to equip learners with individual and team working skills (Lubisi *et al*., 1997:26).

It is generally the case that especially web technology lends itself to non-linear design.

In traditional contact and distance education it is almost impossible for lecturers to provide such individual scaffolding and instruction. At best they can create rich learning environments. This notion is supported by Richey (2000:17) who states that students should be flexible and talented enough to be able to work in diverse settings – hence it is almost impossible to design a unique learning environment based on individual preferences and profiles.

3.5 Web-based instructional design

Similar to neural networks in the brain and multidimensional, complex subject matter, hypermedia consists of a web of interconnectedness, made possible through hypertext – also known as Hyper Text Markup Language (*HTML*). Ross (1993) draws a parallel between hypertext design and Bloom's taxonomy and argues that certain designs, such as a highway design, enable the facilitation of learning outcomes on an evaluation level. A highway design allows for interconnectivity between various subjects within a curriculum and combines linear, exploratory, hierarchical and web-like contents. An active, experience-based learning mode associated with the Internet fits well with adult learning (Yakimovicz & Murphy, 1995). Kommers *et al*. (1996:5) recommend concept maps to assist the learner with navigation. The concept maps could provide graphical overviews that show which nodes have already been visited and via which links a previous link can be reached.

The need for rearranged instructional sequences, multiple dimensions of knowledge representation and multiple interconnections across knowledge components make hypertext protocol a potential enabler to cope with ill-structured knowledge domains.

Supporting this view, Mayer (1983) note that knowledge represented as networks is more complementary to the mental organisational structures that individuals use. Four key knowledge structures that are involved in understanding are concepts, semantic networks, schemata and cases (Davalos, 1997:233). However, Tergan (1997:258) argues against the following assumptions:

- Structural and functional features of hypertext/hypermedia mimic the structure and functioning of the human mind (known as the 'plausibility hypothesis') (Tergan, 1997:258).

- Hypertext/hypermedia match instructional principles for self-regulation and constructivist learning.
- Hypertext/hypermedia match the cognitive principles of multiple modes for the representation of knowledge.

Empirical research, although not representative enough, negate these assumptions and include the following findings:

- “Most of the studies indicate that non-linear structuring of subject matter in a hypertext format did not improve learning” (Tergan, 1997:259).
- Learners who had to locate information did perform significantly better with a linear text than with a hypertext document (Tergan, 1997:267).
- Empirical research indicate that non-linear structuring of subject matter in hypertext format did not improve comprehension and retention of subject matter compared to linear text. Moreover “the results indicate that although hypertext-based learning may have advantages in the amount of facts reproduced in a recall test, text-based learning often resulted in better comprehension and reproduction of central concepts” (Tergan, 1997:263).
- Hypertext networks are not nearly as complex as human semantic knowledge structures (Tergan, 1997:261).
- Many learners did not adopt a constructivist learning style when confronted with a hypertext system that promoted pluralistic non-linear thinking (Tergan, 1997:264).

Responding to the fact that learners did not engage in constructivist learning when provided with an appropriate learning environment,: "…it takes a relatively long period of time to become completely acquainted with a new study environment, especially an environment that stimulates very different learning facilities compared to printed materials. A student will only explore these unfamiliar functionalities after a certain period of time" (Tergan, 1997:266).

Conversely, Clark (1994:26) purports that media in instruction and learning makes no difference to student achievement.
Initial research (Reed *et al*., 1996, cited in Reed *et al*.,1997:288) indicate that learners utilise linear mental models more in contextually strong environments and non-linear mental models more in contextually weak environments. Contextually

weak environments occur where isolated features or steps of hypermedia software are presented in absence of any predisposed sequence or context, and contextually strong environments are characteristic of a strict sequencing of events or actions imposed by the instructor or software (Reed *et al*., 1997:288). Their conclusion is that, to enable learners to better learn the commands, tools or features in a hypertext learning environment, hypertext designers should not restrict learners to the number of mental models, i.e. linear and non-linear. Therefore, in designing courseware, it is instructionally sound to provide frames/scripts and semantic networks (linear), as well as concept maps and schemata (non-linear). In this way, learners can also choose how they construct their own mental models.

This finding supports the notion by Jensen (1995) that the brain prefers a rich learning environment which is not too structured yet contains enough cues. Some structure is necessary in hypertext learning environments, otherwise navigation is blind and the learner gets lost. Yet many attempts would familiarise the learner with the architecture and prompt a construction of a mental model. Calvi (1997:314) finds that the majority of learners preferred using the concept map (non-linear) when they were involved in task-oriented navigation, and conversely the majority of learners preferred using the content list (linear) when they were engaged in free-navigation. She attributes this to the fact that the map is more complete and was therefore regarded as more appropriate when specific information was sought. Ultimately, Calvi (1997:317) concludes that a correlation exists between comprehension and memory for location (space), which she endorses with the following quote by Bolter (1991, cited in Calvi, 1997:317): "Writing is always spatial and each technology in the history of writing (e.g. the clay tablet, the papyrus roll, the codex, the printed book) has presented writers and readers with a different space to exploit".

Kommers *et al*. (1996:5) note that learner control enhances metalearning and the elicitation of prior knowledge during the learning process. This is endorsed by Apps (1991) who states:

"While there is no universally superior mode of learning, mature, motivated adult students learn best when they are in control of their learning and can reconstruct the material in their own terms and in the context of their own interests". Thus virtual learning environments could facilitate learner-centredness.

Hyperlinks (hot spots) could be used to provide additional information, as footnotes do in print-based material, to verify or explain certain concepts, or to provide more knowledge depth if the learner requires it. The learner should be viewed as an autonomous and responsible individual who retains scope for initiative. A fine balance should be sought between providing learner control and a hypertext system that guides the learner in browsing through the information base. Some possible solutions are provided by Kommers *et al*. (1996:38) which should:

- include a navigational device that shows the learner the current position and distinguish between 'need to knows' and 'nice to knows',
- embed goals in the learning activity in such a way that the learner has to investigate all hyperlinks in order to complete specific learning tasks, and
- accommodate variety through holistic and serial structuring of information.

Another possibility would be to require, as part of the learning task, that the learner add other relevant hyperlinks and motivate the chosen links.

Inherent in an electronic platform is the fact that one can access it at any time and place, and at one's own pace. This is similar to what one would find in self-paced print-based study material, because the learners work through units whenever and in whichever way they wish. Some of the electronic advantages for the learner include immediate feedback, record keeping, tracking of progress and live, interconnected links where hypermedia is concerned. In an empirical study by Reed *et al*. (1997:285-304), it was found that learners with different learning styles performed the same in a hypertext learning environment, which could indicate that hypermedia learning environments accommodate all learning styles. Jensen (1995:129) makes a point that "the whole notion of learning styles becomes irrelevant when we consider how much variety the brain works with".

3.5.1 Collaborative web environments

Essentially, variety and choice should be included in any learning environment if said environment is to be effective. This should be done, not only in terms of the mental models incorporated through instructional design, but also in the modes of delivery. This is supported by Kozma and Johnson (1991) who, though before the emergence

of the Internet in education, highlighted the advantage of multiple representations of knowledge structures. Van der Veen and Collis (1997:7) indicate some of the problems that have arisen in collaborative virtual learning environments (web-based):

- "Difficulties in maintaining course cohesion and momentum as learners become immersed in their respective projects".
- "Problems in motivating and structuring collaboration and communication".
- "Problems in organising and executing self- and intergroup evaluation".
- "Problems related to the workload of the lecturer".

Conversely, they remark that some of the benefits to the lecturer include a comprehensive overview of the progress of all groups and having effective channels for providing feedback and remarks.

To address some of the problems identified, they introduced a course *WWW* site that integrates study materials, project-work support and communication tools, by means of which group planning and progress can be visible to all participants. Motivational issues have been attended to by applying co-operative instructional strategies, i.e. each group member has a clear and separate contribution to make, and the groups are kept small enough to be manageable and to promote group bonding. There is also a reporter in each group who is responsible for reporting to the lecturer on a weekly basis during on-line activities.

Bonk and Cummings (1998) point out that web courses require clearer expectations and prompter feedback than traditional classrooms. They also suggest that, when tasks are turned in, they might be accumulated in personal portfolios and assessed using dimensional scoring schemes such as whether the work was insightful, persuasive, inspirational, original, and responsive. On another level, Cortinovis (1992:47) mentions the topicality of reference-based training. This concept holds that there is a need in training to get the right information when and where needed, because people no longer have time to learn all the information available; they have to be equipped with the skill to screen the relevant information. Peraya (1994) confirms this by pointing out that the information overload makes any attempt at memorisation almost futile and that it is rather the ability to process and retrieve knowledge, when necessary, that is important. Previously it was stated that learners should be provided with individual and co-operative learning environments. This idea

is supported by Zhiting (1996:93) whose findings indicate that objectivist or constructivist preferences to learning, along with individualism and collectivism are culturally based. Eastern and African cultures are generally considered to be collectivist, whereas Western culture is individualist (Hofstede, 1980).
Section 3.5.2 discusses web-based course management solutions.

3.5.2 *WWW*-based course-management systems

With the advent of web-based education, innovators at the University of British Columbia created a web-based course management system that would make it easier for lecturers to offer their courses online. The product, called *WebCT* (WebCourseTools) has become a market leader globally. At the same time various initiatives resulted in a range of products that are used at universities and other institutions to facilitate e-learning. Examples include *Blackboard*, currently the other market leader, *TopClass*, *FirstClass*, *Learning Space* and other, in house developed examples like the *Teletop* system at the University of Twente (Netherlands). A comprehensive list of approximately 60 commercially available systems is available online (Landon, 2001).

Collis and Moonen (2001:78) define a *WWW* course management system as follows:

"A *WWW* course management system is a comprehensive software package that supports some or all aspects of course preparation, delivery and interaction and allows these aspects to be accessible via a network". Focusing on web-based learning, Bonk *et al*. (2000) suggest a web integration continuum to incorporate the *web* into the learning environment.

1. Marketing / syllabi	Informational use and course marketing
2. Student exploration	Informational use and value adding.
3. Student resources	Informational use, posting student exemplary work.
4. Course resources	Informational use and learning.
5. Repurpose web resource	Interaction – discussion.
6. Substantive & graded	Interaction outside class environment.
7. Course activities	Web significantly enhances learning environment.
8. Alternative delivery	Web is central focus of course.

9. Entire course on the web	Web is central focus of course. Often entirely 'at a distance'.
10. Larger programmatic	Web is central focus of course and course is part of and integrated into a complete programme offering.

Table 3.4: Ten level web integration continuum (Bonk *et al*, 2000)

The first four levels of this continuum represent informational uses of the Web, such as course marketing, web exploration, and posting instructional resources.
Level five includes online debates and discussions and level six discussions outside the immediate class community.

Levels seven through ten can be characterised as being the central focus of the course. At level nine, courses are offered entirely at a distance for students around the country, without necessarily including face-to-face contact time. At the tenth level, the course is offered as part of a programme offering, in other words as a fully-fledged web-based programme.

Eastmond *et al.* (2001) recommend an incremental approach to implementing a web course. Essential to their strategy is to incorporate a hybrid, or mix of modalities, in other words retaining some contact, face-to-face time and gradually increasing online activities and or components.

Section 3.5.3 discusses the changing role of the lecturer.

3.5.3 Changing role of the lecturer

One of the greatest challenges faced by lecturers is to create a learning community. Bonk & Wisher (2000:27) maintain that e-learning students are usually very task driven. This results in very little exploration, engagement and discussion. If combined with a teacher centred style by the lecturer, even less interaction takes place.

The following five skills are singled out by Wlodkowski (1999:26) as the most critical skills of an instructor:

- Expertise

- Empathy
- Enthusiasm
- Clarity and
- Cultural responsiveness

Bonk & Wisher (2000:11) add the following qualities that are required in an e-learning environment:

- Patient
- Positive
- Friendly
- Responsive
- Caring
- Flexible
- Web-smart

Other guidelines for learning facilitation in a web-based environment include the following roles of a lecturer (Besser & Bonn, 1997; Bonk & Wisher 2000):

- Facilitator
- Mediator
- Mentor
- Provocateur (prompting critical thinking in learners)
- Observer
- Participant
- Co-learner
- Assistant
- Community organizer
- Host

They also note that a lecturer who offers web-based courses requires the following competencies (Bonk *et al*., 2000):

Social skills: nurture social interaction and interpersonal relations, be sensitive to learner social and cultural background, ability to interface with technical support staff,

telematic staff, colleagues involved in offering the same programme, create an ethos of mutual support and community.

Managerial and research skills: planning and management of learning environment, adopt a systems perspective - bigger picture of integration of content/resources, learning process and technologies, regular updating of materials, knowledgeable about relevant web-sites in subject-field.

Pedagogical skills: foster curiosity and intrinsic motivation, provide individual feedback and praise, promote thinking and reasoning strategies, guide and pace learners, practice cognitive apprenticeship - learning situated in real-life situations, structure lesson materials and activities in such a way that interaction involves reflecting, annotating, questioning, answering, pacing, elaborating, discussing, enquiring, problem-solving , linking, constructing, analysing, evaluating, and synthesizing, provide clear expectations.

Technical skills: understand technology and know how to use it to augment learning, understand why it aids the development of higher order cognitive skills and knowledge acquisition, ability to adapt to changing technology.

Kulp (1999) points out that small team collaboration in e-learning requires more time and effort and recommends the following student roles:

- Leader/coordinator
- Resource investigator
- Summariser
- Scribe
- Encourager
- Specialist
- Implementer
- Checker

Mason (1998) advocates the organizational, social and intellectual roles of the online lecturer. A pragmatic statement about the nature of education is made by Wilson & Mosher (1997:5) that regardless of the model of pedagogy, communication is central

to the learning environment: “The learning ‘conversation’ is a communication process in which meanings are negotiated to student understanding of curriculum material”. Curtis and Lawson (1999), cited in Bonk and Wisher (2000:24) designed a scheme for analysing online discourse. They identified types of interactions typically found in collaborative learning situations:

- Receiving help and feedback.
- Exchanging resources and information.
- Explaining and elaborating on information.
- Sharing knowledge with others.
- Challenging others’ contributions.
- Advocating increased effort and perseverance among peers.
- Engaging in group skills.
- Monitoring the efforts of others.

3.5.4 Training and support of lecturers

Schifter (2000: 43) lists the following motivating factors that could help lecturers to become involved in learning facilitation via technologies:

- Personal motivation.
- Opportunity to develop new ideas.
- Opportunity to improve teaching.
- Opportunity to diversify programme offerings.
- Greater course flexibility for students.

Interestingly, administrators listed incentives, such as credit toward promotion or additional money as the second highest motivating factor.

An illuminating finding by Henderson (2001) is that lecturers’ motives for teaching online are good predictors for their perceptions of the efficacy of teaching with technologies and that lecturers who are motivated by additional money are often not good lecturers. Other findings include:

- Sometimes faculty and student goals don't match particularly well. More can be done to communicate goals to students.

- Good instructional practice does not always result in high levels of student satisfaction.
- Include strategies for helping students understand with greater clarity why they are asked to do the kinds of activities required in their assignments.

Inhibitors to participation in technology-enhanced learning environments include the following:

- Lack of technical support.
- Lack of release time.
- Concern about faculty workload.
- Lack of grants for materials/expenses.
- Concern about quality of courses.

According to research by Van der Kamp (1996) the following are the main barriers to adult learning:

- Cost
- Lack of time

There is sufficient evidence that virtual learning environments facilitate constructivist learning. It is, however, important to analyse possible practical challenges and solutions.

Wlodkowski (1999) (see Annexure A) provides a comprehensive list of motivational strategies that can be used. The strategies will be discussed when they are later compared to existing practice in samples of the University of Pretoria's web-based courses.

Section 3.5.5 describes the role of project management in the design and development of flexible learning environments.

3.5.5 Project management

Bates (2000:66) argues that the use of project management in an instructional technology environment leads to improved quality and cost effectiveness.

Steyn (1998:2) states that the Project Management Body of Knowledge (PMBOK) describes a *project* as “a temporary endeavour undertaken to create a unique product or service”. He proceeds to define it as “any planned, temporary endeavour undertaken to create a unique product, service or other complete and definite outcome within a limited time scale and budget”. A *programme* is normally a large project that consists of smaller projects.

Project management entails a scope, i.e. project objectives or the sum of products and services to be provided as a project; a work breakdown structure that assigns people to deliverables and time lines and costs (Steyn, 1998:6).

In an instructional design and development environment teams are usually assembled that consist of different roles. The roles are typically those of project or course manager, project leader (academic), instructional designer, subject expert, instructional technologist/author/multimedia developer and sometimes a graphic designer, editor and programmer (Bates, 2000:67). Sometimes the lecturer takes on all three roles of subject expert, designer and developer. A kick-off meeting will clarify design principles, after which an iterative process of design and development is followed. Bates (2000:69) points out that it is best to link such projects at higher education institutions to earmarked funds in order to promote innovation. A helpful tool to achieve this is by means of project proposals. A project proposal should address the budget, team members and roles, copyright, revenue, the educational model, a schedule and a process for revision and maintenance (Bates, 2000:70).

Project management in an educational setting could clash with the culture of freedom and autonomy of academics. Hence its implementation requires flexibility and sensitivity. Bates (2000:72) warns against a perception that can arise of project management being bureaucratic, expensive and unnecessarily complicated. He continues to identify technology and instructional support as two critical factors in the adoption rate of technology in the learning environment. A recommendation of a ratio of one technical support person to every twenty or thirty full-time instructors, and one instructional designer to every thirty to fifty instructors is given. Also that these support staff need to be located close to the department (Bates, 2000:106).
Section 3.6 provides an overview of structures and processes that international higher education institutions have implemented to support virtual education.

3.6 International case studies

University	Approach	Learners	Processes	Structures	Infrastructure
Open University (U.K.) [http://www.open.ac.uk]	To provide flexible learning opportunities to working adults.	The number of learners connected via home computer to the OU to communicate with their tutors has risen from 5 000 in 1995 to 30 000 in 1997 (Daniel, 1997). Students (164 000) in 41 countries, mostly working adults	Project management: Course chair (senior academic), course manager/project manager (administrator), educational technologist/instructional designer, academic computing person.	Knowledge media institute	On a macro level, the OU has moved into a flexible learning system, partly through the use of technology. Print, broadcasting, audio cassettes, video, videoconferencing, CD-ROM, Web-based courses (80 000 students are studying online).
Massachusetts Institute of Technology MIT (U.S.A.)	Competitiveness, value-adding to residential courses	Students	Currently establishing processes to put all courses on the web	Media lab, Centre for Advanced Educational Services [http://www-caes.mit.edu]	Videoconferencing, CD-ROM, video, Web-based courses (Mainly Engineering and Management).

University	Approach	Learners	Processes	Structures	Infrastructure
Virginia Tech (Virginia Polytechnic Institute and State University) (U.S.A.)	To provide flexible learning opportunities to students.	Students (23 000)	CyberSchool's mission is to redesign course offerings that take full advantage not only of emerging instructional technologies but also of shared insights among faculty members about the way students learn using technology. The CDDC has created two publishing systems that enable people to publish online in the form of e-books and e-journals.	Distance and Distributed Learning (established in 1999)[www.iddl.vt.edu], Faculty Development Institute [http://www.fdi.vt.edu], Educational Technology, Center for Excellence in Undergraduate Teaching Center for Innovation in Learning [http://www.edtech.vt.edu/cil] Centre for Digital Discourse and Culture (CDDC), Cyberschool [www.cyber.vt.edu] Electronic Reading room and Distance Learning Classrooms	Print, videoconferencing, CD-ROM, Web-based courses (12 programmes).[www.vto.vt.edu] Both WebCT and Blackboard are used for web-based courses
University of Phoenix	For-profit professional courses Private institution	Adult learners in paid employment 65 000 students	Project management	80 Learning centres in 13 states, centralised courseware design and development unit	Face-to-face contact, web-based, paper-based. Full access online to materials, support, library and administrative services.
Open University of Catalonia		8000 students		Learning centres	Combines multimedia applications, e-mail, videos, tapes and face-to-face contact. Full access online to materials, videos, tapes and face-to-face contact. Full access online to materials, support, library and administrative services.

University	Approach	Learners	Processes	Structures	Infrastructure
Fern Universität (Germany)	Public distance education university, lifelong learning opportunity	56 000 students		60 Learning centres in 10 countries	Paper based, multimedia and web-based. Currently creating a virtual university by providing all materials, academic and administrative support and delivery online.
Indira Gandhi Open University [http://www.ignou.edu.socis/vci]	Adults, lifelong learning, flexible learning	About 6000 students make use of online facilities	Unknown	Unknown	Paper-based, Web-based, satellite-based teleconferencing, and CDROM
National University of Singapore	New market of continuing education through flexible and online learning				Integrated learning environment, 600 courses online
University of Southern Queensland	Blend of distance education and residential – flexible learning	15 000 of which 3000 study off0shor	Project management		24 Courses offered completely online
Virtual-U project (Simon Fraser University (Canada)	Commercial – marketing of courseware and other learning products	7000 students study online			Designed their own web-based management system
Athabasca University (Canada)	Distance education shifting to virtual education				Web-based (50+ courses), paper-based

University	Approach	Learners	Processes	Structures	Infrastructure
Stanford University (Stanford Online)	Adding value to existing programme offering, cost effectiveness		Project management: instructional designers and technologists.	Stanford learning lab	Television, Web-based (especially short courses, management and engineering), multimedia and residential.
Maryland University College (U.S.A.)	Mixed model, flexible learning	More than 60 000 students, mostly employed			Integrated online administrative and academic services (student portal), face-to-face contact, multimedia, video.
De Montfort University (U.K)	E-campus to reach more students				Web-based, videoconferencing, face-to-face contact, video, multimedia, interactive satellite broadcasting. Online library services.
Harvard University	Leading edge, competitiveness	Business school – majority of MBA students study off-campus			Programmes and programme administration provided online (Business School)
British Aerospace Virtual University (U.K.)	Provision of learning resources for immediate reference and work application	Employees (43 000)	Learning goals identified and matched with appropriate study programme.	Learning centres, Online learning and development guide, personal development programmes.	Print, audio cassettes, CD-ROM, Web-based courses.

Table 3.5: International case studies (Sources: HEFCE, 2000; Farrell, 2001; personal visits)

Another California project mandated by an order from the governor in April 1997 and in design through August 1998 is the California Virtual University (CVU) (Deloro, 1997). Offering centralised access to course listings and related services, CVU was planned as a comprehensive virtual catalogue of the state's 106 community colleges, 164 independent colleges and universities, 23 California State University System campuses and nine University of California campuses. Currently close to 2000 courses are offered online and 95 institutions are participating (Farrell *et al.*, 2001:33). It seems however as if the university has found initial private sector funding to be insufficient and is struggling to remain sustainable. This is reminiscent of the Western Governor's University (WGU) – a partnership between about twelve major public universities in the western United States. WGU is basically a clearing house of online courses, specifically related to work-related, competence-based qualifications.

Section 3.7 gives an overview of the South African higher education landscape. It includes a brief discussion on telecommunications infrastructure in Africa.

3.7 South African context

Many residential higher education institutions in South Africa have adopted distance education as part of their main- stream activities in an attempt to meet market needs. An overview is provided in Chapter Four.

Flexible learning is a vehicle for transformation, as encapsulated in the *White Paper on Higher Education*: "To promote the development of a flexible learning system, including distance education and resource-based learning on open learning principles" (South Africa, 1997, 5: 1.27).

"It will promote the development of a flexible learning system, progressively encompassing the entire higher education sector, with a diversity of institutional missions and programme mixes, a range of distance and face-to-face delivery mechanisms and support systems, using appropriate, cost-effective combinations of resource based learning and teaching technologies" (South Africa, 1997, 7: 2 6).

The Department of Education has adopted an outcomes-based approach to education, the quality of which will be assured by the South African Qualifications Authority (SAQA) (South Africa, 1997).

The main principles underlying outcomes-based education are lifelong learning, flexible education and training structures, the integration and transfer of learning, and the need to teach towards critical, cross-field and specific outcomes. Competence is seen as combining skill, values and knowledge (Gultig, 1997).

Critical, cross-field outcomes are considered working principles and are generated across sectors in a process of consultation among stakeholders. These cross-field outcomes would promote the development of basic skills such as **communication, critical thinking, problem-solving** and **team working skills**, which are necessary for functioning in a changing, modern society (Lubisi *et al.*, 1997:11). In this sense, a broad band of competence will gradually build capacity in South Africa and possibly contribute to a better economy.

Specific outcomes are context-specific and describe the competence which learners should be able to demonstrate in particular areas of learning at certain levels. These outcomes should be assessed according to criterion-referenced methods, which means that performance standards and criteria are clearly communicated to learners (Mager, 1991). Learners are subsequently measured against the pre-stated criteria and are not assessed against other learners' performances, as has been practised in norm-referenced assessment. It follows that because learners know what is expected of them, the assessment process is transparent and does not rely on the subjective impression of the lecturer.

Technology-enhanced summative assessment remains something to be explored, as invigilation and very strict security systems will be required.

An important shift in the outcomes-based approach is that there is often more than one answer to a problem, depending on the context involved. This, along with the emphasis on formative assessment rather than only summative assessment, agrees fully with constructivist principles, as learning is a process and continual assessment and feedback are essential.

Alley, (1996) contends that assessment is far too undervalued as a potentially active tool of quality learner-centred learning. It should be woven into the basic fabric of the teaching and learning process so that it both reflects and enhances learning. Many books and articles have been written describing creative tactics for embedding assessment which, at its best, becomes a continuous cycle of feedback to both the learner and lecturer, not only about learner achievement, but also about learners' need for effectiveness and focus from the self-adaptive, technology-supported learning environments that are now feasible.

Outcomes-based education focuses on learner-centred education, which is aligned with the constructivist principle that the learner has to construct meaning. The same principles are echoed in outcomes-based education, viz. “Different learning styles and rates of learning need to be acknowledged and accommodated both in the learning situation and in the attainment of qualifications. The ways in which different cultural values and lifestyles affect the construction of knowledge should also be acknowledged and incorporated in the development and implementation of learning programmes” (Lubisi *et al*., 1997:4). This need for cross-cultural portability of learning environments is explored later.

Other important principles in outcomes-based learning facilitation are:

- An understanding of the role of motivation in learning,
- assessing and using learners' prior learning,
- inventoring learners’ learning styles,
- understanding the nature of learning processes and how to best-fit learning styles,
- using collaborative/co-operative learning,
- using problem-based learning,
- assessing course and learner outcomes, and
- knowing how to use instructional technologies (Gultig, 1997).

One of the most pressing problems facing society is the digital divide. South Africa is an ideal research ground in which both the first world and third world co-exists. According to a report on the status of the African Internet (Jensen, 2001), the Internet has grown rapidly in Africa. There are now more than a million dialup Internet subscribers and the total international Internet bandwidth reached over 1 gigabyte per second. Jensen notes, however that this growth has been largely confined to major cities in Africa where the minority of the population lives. He mentions South

Africa as an exception which have points of presence (POPs) in about 100 cities and towns. The connectivity in South Africa is remarkable if one takes into account that there are only 250 POPs in total in Africa. The dominance of South Africa in this regard can be seen graphically in Figure 3.4.

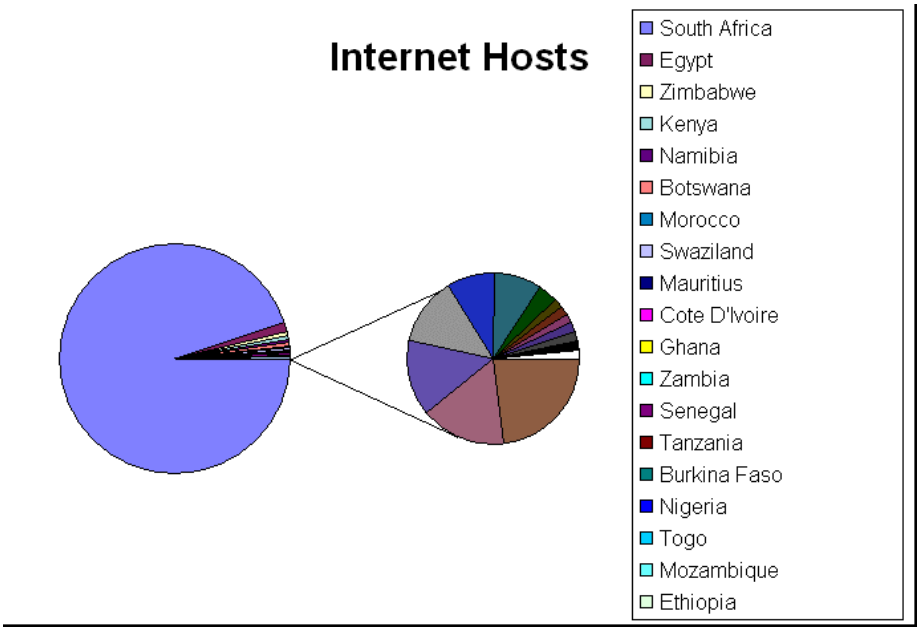

Figure 3.4: Status of the African Internet (Jensen, 2001)

It is difficult to estimate the total number of Internet users in Africa. The number of dialup subscriber accounts of the ISPs in Africa total more than 1 300 000. Of these 750 000 are in South Africa, 250 000 in North Africa and remaining 300 000 in the remaining 50 African countries. According to Naidoo & Schutte (2001:95) a ratio of one Internet user for every 5000 people is implied, compared to a world average of about one user for every 30 people and the North American and European average of about one in every 3 people. As can be seen from these statistics South Africa is by far the leader in Internet connectivity and its average is close to the North American / European average.

The average total cost of using the Internet is still very expensive in Africa. Based on an estimate by Jensen (2001), the average total cost for 20 hours a month is about R 600 a month. This includes usage fees and local call telephone time, but not the telephone line rental. Initiatives to improve public Internet access include a rapidly growing number of kiosks, cyber cafés and PCs in phone-shops, schools, police stations and clinics.

Obtaining sufficient international bandwidth still remains a major problem as can be seen from Figure 3.5, which gives an overview of Internet access and bandwidth in Africa.

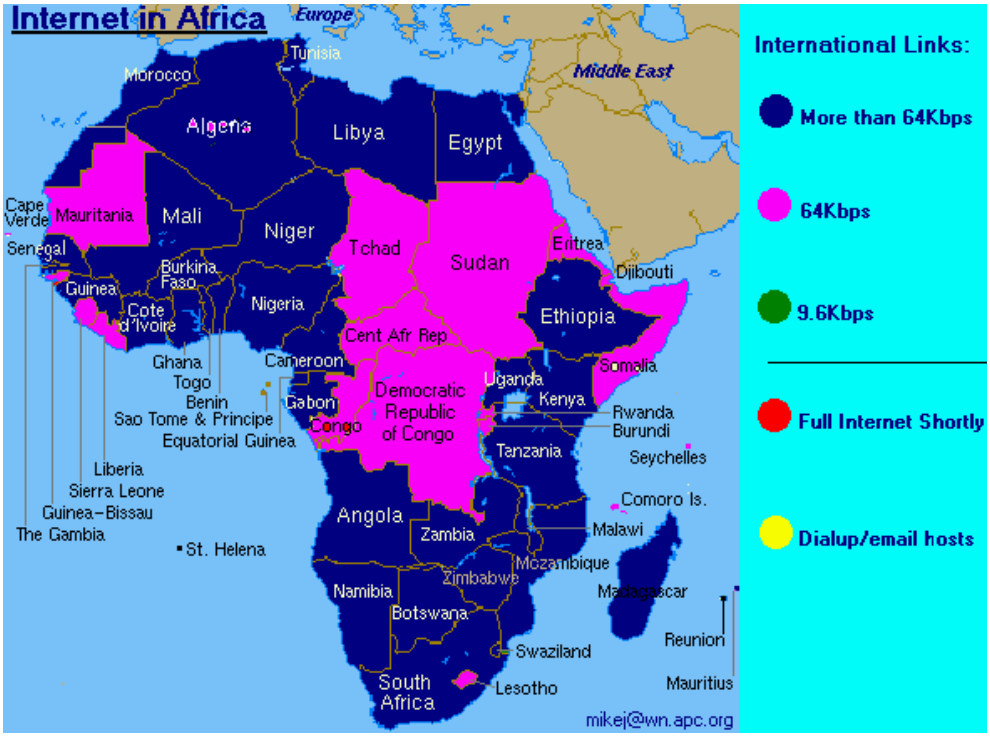

Figure 3.5: Internet Access and Bandwidth in Africa (Jensen, 2001)

Despite the "digital divide" the use of ICT in higher education is not only a priority in developed countries but also a matter of extreme urgency in developing countries such as South Africa. It is of great importance that universities in South Africa remain competitive in the international higher education market. The importance of ICT in higher education is emphasized in the report "Towards a New Higher Education Landscape: Meeting the Equity, Quality and Social Development Imperatives of South Africa in the 21st Century (CHE, 2000). The report outlines the challenge to integrate information and communications technologies. President Mbeki also acknowledged the influence of ICT on higher education in his State of Nation address in February 2001 when he emphasized that the application of modern communication and information technology in the fields of education, health, commerce and government will be expedited.

Section 3.8 provides a benchmark regarding quality in virtual education.

3.8 Quality in virtual education

Quality in education has become prevalent with the shift to a more customer- focused orientation and questions about the cost of higher education.

The Institute for Higher Education Policy (2000) conducted an evaluation of Internet-based electronic education. The results are published in an article: "Quality on the Line": Benchmarks for success in Internet-based electronic education. After an extensive research process, 45 benchmarks were identified to ensure quality in Internet-based electronic education. They selected 6 institutes to rate these benchmarks according to importance, i.e. 1 = not important, 5 = very important. They recommended **24 benchmarks** essential for quality Internet-based education. The purpose of these benchmarks is to assist policymakers of universities and colleges as well as faculties and students to make reasonable and informed judgments with regard to quality of Internet-based electronic education.

The benchmarks will be applied to the case study in Chapter Four.

Benchmarks

Institutional support

1. A documented technology plan that includes electronic security measures (i.e., password protection, encryption, back-up systems) is in place and operational to ensure both quality standards and the integrity and validity of information.
2. The reliability of the technology delivery system is as failsafe as possible.
3. A centralized system provides support for building and maintaining the electronic education infrastructure.

Course Development

4. Guidelines regarding minimum standards are used for course development; design and delivery, while learning outcomes – not the availability of existing technology – determine the technology being used to deliver course content.
5. Instructional materials are reviewed periodically to ensure they meet program standards.
6. Courses are designed to require students to engage themselves in analysis, synthesis and evaluation as part of their course and program requirements.

Teaching/Learning

7. Student interaction with faculty and other students is an essential characteristic

Benchmarks

and is facilitated through a variety of ways, including voice-mail and/or e-mail.

8. Feedback to student assignments and questions is constructive and provided in a timely manner.

9. Students are instructed in the proper methods of effective research, including assessment of the validity of resources.

Course structure

10. Before starting an online program, students are advised about the program to determine:

    - If they possess the self-motivation and commitment to learn via electronic education and
    - If they have access to the minimal technology required by the course design.

11. Students are provided with supplemental course information that outlines course objectives, concepts and ideas and learning outcomes for each course are summarized in a clearly written, straightforward statement.

12. Students have access to sufficient library resources that may include a “virtual library” accessible through the *WWW*.

13. Faculty and students agree upon expectations regarding times for student assignment completion and faculty response.

Student Support

14. Students receive information about programs, including admission requirements, tuition and fees, books and supplies, technical and proctoring requirements, and student support services.

15. Students are provided with hands-on training and information to aid them in securing material through electronic databases, interlibrary loans, government archives, news services and other sources.

16. Throughout the duration of the course/program, students have access to technical assistance, including detailed instructions regarding the electronic media used, practice sessions prior to the beginning of the course and convenient access to technical support staff.

17. Questions directed to student service personnel are answered accurately and quickly, with a structured system in place to address student complaints.

Faculty Support

18. Technical assistance in course development is available to faculty who are encouraged to use it.

Benchmarks

19. Faculty members are assisted in the transition from classroom teaching to online instruction and are assessed during the process.

20. Instructor training and assistance, including peer mentoring, continues through the progression of the online course.

21. Faculty members are provided with written resources to deal with issues arising from student use of electronically accessed data.

Evaluation and Assessment

22. The program's educational effectiveness and teaching/learning process is assessed through an evaluation process that uses several methods and applies specific standards.

23. Data on enrolment, costs, and successful/innovative uses of technology are used to evaluate program effectiveness.

24. Intended learning outcomes are reviewed regularly to ensure clarity, utility and appropriateness.