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**IMPLEMENTING ONLINE LEARNING FOR STUDENTS OF
COMPUTER END USING AT VUT**

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BSc Hons (Computer Sciences)**

**Dissertation submitted in complete fulfilment of the requirements for the degree
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in the Department of Information and Communication Technology
in the Faculty of Applied and Computer Sciences, Vaal University of Technology**

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DECLARATION

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ABSTRACT

The personal computer has changed the way people think and live and has found its way into every area of life. The ability to work with computer technology is a requirement for today's world. The number of virtual learning environments (VLE's), is increasing and e-learning has been promoted as a solution for remote education. Computer literacy, the ability to use computers to perform a variety of tasks, is becoming fundamental to the learning process.

Students need to be computer literate, because they are expected to use the computer in most of their subjects, by completing projects, perform electronic searches or typing assignments, to name a few. Many of the learners, who enrol at Vaal University of Technology (VUT), do not have this basic skill, and a great number of them do not have their own computers. It is thus still necessary for VUT to offer a subject such as Computer End Using to provide the learners with the basic level of computer literacy.

According to the South African Qualifications Authority, computer literacy is on NQF level 4. Although computer literacy is regarded as being at a lower level than the first year in higher education, it remains a vital prerequisite for completing qualifications. It is therefore important that higher education institutions offer training for fundamental computer skills. This is also supported by the National Plan for Higher Education (NPHE), which emphasizes the mainstreaming of academic development.

VUT faces a challenge in terms of providing computer literacy training through online learning. The exact skills the students need in order to engage in online learning, are the same skills taught online, subsequently these programmes require motivated learners with fundamental computer skills. The two online learning packages that were investigated in this study were a national product (HS Training) and an international product (SimNet). An informed recommendation was made with regard to the software

package that would be most suitable for VUT students to become computer literate through online learning.

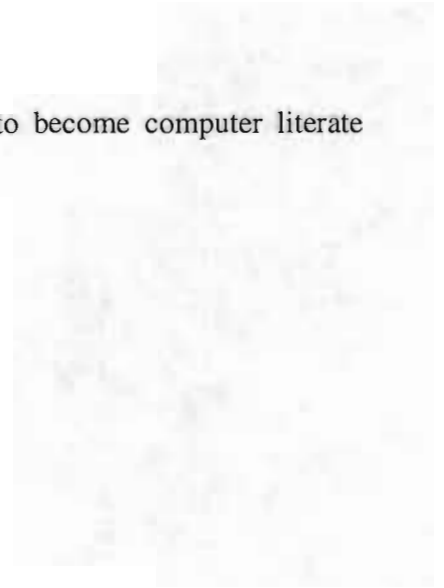


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CHAPTER 1

INTRODUCTION AND OVERVIEW OF THE STUDY

1.1 BACKGROUND

Computer literacy refers to the level of expertise and familiarity someone has with computers, and may also be viewed as the ability to use applications (Webopedia 2004). This chapter introduces the concept of online computer literacy training for VUT students.

Students need to be computer literate, because they are expected to use technology in most of their subjects in order to complete projects, performing electronic searches, type assignments and other related activities. Many students who enrol at Vaal University of Technology (VUT) lack this basic skill, and a majority of these students do not have their own computers. It is therefore essential for VUT to offer a subject such as Computer End Using to provide the students with a basic level of computer literacy.

According to the South African Qualifications Authority, computer literacy is on NQF level 4 (SAQA 2004). Computer literacy is regarded as being at a lower level than the first year in higher education, but is a vital prerequisite for completing tertiary qualifications and higher education institutions need to offer training for fundamental computer skills. The National Plan for Higher Education (NPHE) emphasises the mainstreaming of academic development, this includes the provision of computer literacy training.

The exit level outcomes of the Computer End Using module, as described in the student study guide, are as follows:

- maintain the files on a PC and other storage media (Operating Systems);
- competently use an editor or word processor (Word Processing);
- competently use a spreadsheet (Spreadsheets).

All computer skills training at Vaal University of Technology is currently conducted by Instructor Led Training (ILT) in the computer laboratories. ILT refers to traditional classroom activity, where training is mediated by a live instructor (Kruse 2004). Instructor led computer literacy training places a very high demand on the number of available computer laboratories and the Computer End Using department occupies a large number of these venues. VUT management has expressed concern over the under-utilisation of valuable resources such as laboratories and highly skilled lecturers with regard to the teaching of a basic skill such as computer literacy (Du Pré 2004).

In an effort to continue provision of quality education in the midst of increased pressures faced by educational institutions, a collaborative decision was taken by the Management of VUT and the Computer End Using department to alternative methods of computer literacy training (Du Pré 2004). Technology-supported learning has been investigated as an alternative instructional strategy. It is necessary to consider viable strategies that will bring technology into the teaching and learning process.

Different terms have been used to describe technology aided learning, the following section contains definitions of e-learning, web-based learning, online learning and blended learning, which are often used interchangeably.

E-learning, according to Horton (2001:1), is “the use of the internet and digital technologies to create experiences that educate our fellow human beings”. Hartley (2001:1) describes it as “any type of learning that is enabled or delivered to students by Internets and Intranets or other types of computer networks”. Within the context of learning to use a computer the following quotation is relevant:

Tell me and I will forget.

Show me and I will remember.

Involve me and I will understand.

(Confucius)

Online learning, alternately called distance education, refers to courses being offered online and subsequently do not require the student to be on campus for class participation. Students can work on course materials in their own time or they can work collaboratively on class projects using electronic communication tools such as chat and discussion groups (Office of Information Technology [OIT] 2004). The online encyclopedia, Wikipedia (2006) defines **online learning** as the use of technology and not necessarily the Internet, to achieve a learning objective as defined by the educator.

Web based learning describes training and/or instruction delivered over the Internet or an Intranet using a Web browser (Webopedia 2004). Content may be delivered by means of the Internet, satellite broadcast, interactive TV, and DVD- or CD-ROMs (OIT 2004).

Blended learning refers to the combination of offline and online forms of learning where the online learning usually means “over the Internet or Intranet” and offline learning involves a more traditional classroom setting (Singh 2003).

“Online learning” and “blended learning”, will be used interchangeably in the remainder of this document, as these terms encapsulate the method of learning that has taken place. E-learning and web-based learning refer to the use of the Internet, these terms are not applicable for this study since students cannot use the software at home are compelled to work in the computer laboratory.

According to international studies, technology solutions are not necessarily cheaper, but are more cost-effective, eliminating many of the problems with resources, contact

time with lecturers and complex scheduling problems (Surrey & Land 2000; Inglis, Ling & Joosten 2002). Instead of assuming the role of a passive participant, students must actively engage in online learning and exert more control over the work agenda and timing.

Traditionally learning required that students and instructors be brought together physically so that communication and the sharing of knowledge could take place. The digital age has changed the methods of delivering training, as well as perceptions of the roles of students and teachers (Horton 2001:1). Frank, Reich and Humphreys (2003:61) found in their study that students felt insecure with the computer as learning instrument. Fear of this unknown learning mode was shared by all students without exception. According to Hill (1997) the students' concerns with regard to the operation of computerised equipment could be ascribed to a lack of basic skills in computer literacy: "With hindsight we found that the students needed considerably more training in the technology before embarking on the project than what they were given" (Frank *et al.* 2003:63).

According to Smith (2001:2), adults prefer to learn new technical processes by first being shown how to perform the task. If the tool or process used for learning is different or brand new, it is avoided by most students, unless they are shown how it works in the learning situation (Smith 2001:3).

VUT faces the challenge of teaching, through online learning, because it is necessary to teach, through online learning, the exact skill the students actually need to be able to engage in online learning: "These programs require motivated students with basic computer skills..." (Driscoll 2000:4).

Two software packages, namely a national developed product (HS Training) and an international developed product (SimNet) were evaluated in this study. An informed recommendation was made in terms of the software package that would be most suitable to provide online learning for VUT students to become computer literate.

1.2 PROBLEM STATEMENT

The research problem that was investigated in this study is contained in the following questions:

1. Can a set of guidelines be developed for the application of online learning for computer literacy skills at VUT, where the majority of students come from a previously disadvantaged background?
2. Which of the two software packages (SimNet or HS Training) will be most appropriate for VUT students to use?
3. Does the competence level of students who completed the online learning course differ from the competence level of students who completed the same course by means of Instructor Led Training (ILT) at VUT?

1.3 AIMS OF THE STUDY

The aims of the study are as follows:

1. To develop a set of guidelines for the application of online learning for teaching computer literacy, where the majority of students come from a previously disadvantaged background.
2. To investigate two software products (SimNet and HS Training) and their characteristics for the provision of online computer literacy training.
3. To determine whether a difference can be discerned between the competence level of students who completed online computer literacy training, and that of students who completed the same course by means of instructor led training (ILT).

1.4 RESEARCH METHODOLOGY

1.4.1 Literature Study

A comprehensive review of literature pertaining to technology aided learning, with the emphasis on the implementation of online learning in practical fields of study at higher education institutions was conducted. Sources consulted include journals, Internet, databases (Nexus, Sabinet, Emerald and Ebscohost) and books.

The following key words were used: **online learning, e-learning, web-based learning, blended learning, schools of thought on learning.**

1.4.2 Empirical Research

A quasi-experimental design is commonly used in the evaluation of educational programmes when random assignment is not possible or practical (Gribbons & Herman 1997). Using this design the students were divided according to classes, into two study groups (an experimental and a control group). A preliminary questionnaire was given to both groups to determine their competence level and language preferences. Both groups wrote a traditional paper-based test covering all three outcomes of the module (Operating systems, Word, Excel). The experimental group wrote paper-based as well as online assessments. Quantitative data regarding students' performance, combined with qualitative data from feedback forms and observations made throughout the study, were used to answer the research questions.

The following phases were conducted for the empirical research:

Phase 1: The international developed online learning software package (SimNet) was obtained and installed in a computer laboratory.

Phase 2: Students were divided into two groups (a control and experimental group). The online learning groups received an initial training session on using the online learning software package.

Phase 3: Observations were made during the use of the software packages and the progress of both groups was monitored throughout the course.

Phase 4: The same post-assessment was given to both groups to determine their competence level after completing the syllabus.

Phase 5: The results of the assessments were collated and statistical analysis was performed on the data so that the findings could be interpreted in view of the literature pertaining to online learning and computer literacy training.

Phases 1 to 5 were repeated using the HS Training software online learning package.

1.4.3 Data Analysis

A complete report was compiled, containing the results from the tests written, and observations were made throughout the semester. The statistical package that was used for the data analysis is Microsoft Excel.

1.5 BENEFICIARIES

1.5.1 Computer End Using Students

All students who are enrolled at VUT should complete a Computer Skills course. There are positive indications that self-directed, flexible learning could be a more suitable instructional strategy than the traditional instructor-led training. A higher rate of accuracy in the computer packages they learn to use might be achieved, since the students using the online learning software packages will have the opportunity to exercise skills and rewrite tests as many times as desired.

1.5.2 Lecturers involved in Computer End Using

Reduced contact time and resource allocation will allow more time and staff capacity for core computer modules.

1.5.3 Vaal University of Technology

Results from this project could be implemented across the institution to foster future online learning offerings. Providing flexible and self-directed learning opportunities will support the NPHE to create lifelong learners (RSA 2001).

1.6 BRIEF OVERVIEW OF DISSERTATION

The research and conclusions of this study are discussed and summarised in the following chapters:

Chapter 1 is an introduction and overview of the study.

Chapter 2 looks at the implementation of technology in learning, and the foundations of the educational theory. From this the characteristics of good online learning material are derived.

In chapter 3 the research design followed in this study is described.

Chapter 4 draws on the characteristics and guidelines reached in Chapter 2, and the software packages for the online offering of computer literacy are evaluated accordingly.

Chapter 5 presents the statistical analysis of the competencies reached by students using the online learning packages, to determine if there is a difference in the competencies of students who completed an online learning course as opposed to students who received ILT.

Chapter 6 contains the conclusions and recommendations of this study.

CHAPTER 2

THE IMPLEMENTATION OF TECHNOLOGY IN LEARNING – THE FOUNDATIONS OF EDUCATIONAL THEORY

2.1 INTRODUCTION

We cannot feed the starving, we cannot stop war; we are in a terrible muddle with education, transportation, the care of the sick and old; institutions are failing, and we often feel unsafe in the streets of our own cities. All this is inefficient. Then it cannot be correct to say that the way to preserve liberty is to be so damned inefficient that freedom is not even threatened. We have to become efficient on order to solve our problems; and we have to accept the threat to freedom that this entails – and handle it.

(Beer 1973)

In this chapter, the foundations of educational theory will be discussed. The first part of this chapter describes online learning as a broad concept. The second part is concerned with the possible implications of the different schools of learning on the selection of electronic learning materials.

The personal computer has changed the way many people think and live and has found its way into every area of life. Computer literacy is a requirement for today's world. The number of virtual learning environments (VLE's) is increasing and online learning has been promoted as a solution for remote education (Koskela, Kiltti, Vilpola & Tervonen 2005:21). Computer literacy, the ability to use computers to perform a variety of tasks, is becoming fundamental to the learning process. The term "information age" has been used to describe the twentieth century and the next century has been described as the "information processing" age. A variety of computer skills is useful and often required

as an essential part of tertiary learning and employment for most individuals. Computer literacy refers to the level of expertise and familiarity someone has with computers, and refer to the ability to use applications (Webopedia 2004).

Higher Education in South Africa is challenged by the immense backlogs created by years of segregated education during apartheid. Illiteracy rates over 30 percent for adults above the age of 15 years (6-8 million adults are not functionally literate), teachers in township schools are poorly trained, and the grade 12 pass rate remains unacceptably low. Although 65 percent of Whites and 40 percent of Indians over 20 years of age have a high school or higher qualification, this figure is only 14 percent for Africans and 17 percent for the Coloured population (Garson 2003). At VUT 95 percent of students are from the previously disadvantaged groups who in the past were subject to a dysfunctional, racist educational system (Cilliers & Kiplin 1997). English is the first language of only 10 percent of VUT students (VUT 2006). All Computer Based Training is conducted in English and it remains to be seen whether students can cope with English as medium for online learning. It must be noted that online learning limits facilitation by a lecturer or tutor to address language issues including terminology. There is a perceptions among lecturers that many students enrolled at VUT will not be able to cope with online learning. This study was therefore undertaken to determine whether VUT students could successfully use an online learning programme.

Physical classrooms have been the dominant forum for the transfer of knowledge for at least 3 000 years. Today almost 80 percent of training is still conducted in a physical classroom. However, the past decade has witnessed the introduction of new technologies for learning and collaboration (Singh & Reed 2001:1).

One of the new technologies is **online learning** which may be defined as using the Internet to access learning material, interact with the content, instructor, and other students, and obtain support during the learning process; in order to acquire knowledge,

construct personal meaning, and foster growth from the learning experience (Ally 2004:5).

During the study VUT students did not use the Internet to access the learning materials, therefore other terms used in a similar sense as online learning, such as e-learning and web-based learning are also considered.

Another new methodology is **Blended Learning**. According to Singh and Reed (2001:1) blended learning is a learning programme where more than one delivery mode is used, with the objective to optimise the learning outcome. Rovai and Jordan (2004:1) define blended learning as a hybrid of classroom and online learning that offers the advantages of online courses without a complete loss of personal contact.

A number of studies have been conducted on the successful implementation of online learning at various institutions worldwide. Several case studies (Piccoli, Ahmad & Ives 2001; Zhang, Zhao, Zhou & Nunamaker 2004) have specifically addressed the use of distance learning methods in Information and Communication Technology. It has been reported that the online learning environment is more effective, efficient and satisfying than the traditional Instructor Led Training (ILT) environment. A case study conducted by Piccoli *et al.* (2001), reported that the difference in results for a group who received traditional class teaching and a group who used technology to learn the same content was not statistically significant. Furthermore the Piccoli case study indicated that the group who received online learning were less satisfied than the group in the traditional class environment.

Two issues have received considerable attention in the literature relating to hisher education. Higher dropout rates for distance education over traditional programmes (Bernard & Amundsen 1989; Carr 2000) and low quality learning attainment are perceived by certain educators and students (Abrami & Bures 1996). This contradicts

evidence that suggests that distance education is capable of achieving similar or superior results when compared to traditional courses (Verduin & Clark 1991). Subsequently educators have expressed concern regarding the nature of distance learning environments and the learning possibilities achievable through technology. Addressing the associated problems is critical for the successful implementation of online learning education programmes. The characteristics and guidelines for the successful implementation of online learning will be investigated to ensure that implementation at VUT avoid these problems. High dropout rates, low quality of learning and low satisfaction of students should not form part of the VUT online learning experience.

Clark (1983) claims that technologies such as personal computers are merely the vehicles that deliver instruction, but do not directly influence student achievements. According to Schramm (1977), learning is influenced more by the content and instructional strategy in the learning materials than by the type of technology used to deliver the instruction. To promote higher-order thinking, online learning must create challenging activities that enable students to link new information to old, acquire meaningful knowledge, and use their meta-cognitive abilities (Bonk & Reynolds 1997). According to Rosset (2002) online learning holds promise, but requires commitment and resources for successful learning. Online materials must be designed properly, with the students and learning in focus, in order to unlock the benefits of online learning.

2.2 BENEFITS OF ONLINE LEARNING

An increasing number of organisations are adopting online learning as the main delivery method to train employees (Simmons 2002). Similarly educational institutions are moving toward the use of the Internet for delivery of information. In order to justify an expensive shift to technological learning, the perception that technology provides major benefits is essential for institutions.

A number of the benefits of online learning, as described by Ally (2004) are discussed below:

- **Flexible scheduling**
Students can complete selected courses at any time without attending weekly classes.
- **Enhanced learning**
Time saved due to learners being able to plan their work accordingly to their schedules, can be redirected for learning.
- **Adult learners**
As highly motivated learners, adult students can actively pursue areas of greatest interest rather than sit through lectures aimed at the whole group.
- **Electronic competency on the job**
The competence to deal with electronic environments that students develop in online courses is of great value in the workplace.
- **Collaboration**
Students, instructors and colleagues are able to communicate and collaborate across campus or around the world, using e-mail, bulletin boards or other methods of electronic communication.

Although the benefits of online learning have been documented there are many implications for implementing an online learning programme that require careful consideration. Implementations of online learning programmes in Higher Education have been superficial in some cases, in terms of learner participation. For many students online learning is associated with endless reading of screen-based text, this result in limited learner participation. Online learning is relatively new to South Africa although an increasing amount of online learning takes place on campus in traditional contact institutions.

During the apartheid era, South Africa maintained disparate higher education systems organised along racial lines, with vastly inferior institutions catering for black students. The scars of this segregated education system run deep and require time and effort to heal fully. A consequence of these inequities is that many talented young people are ill prepared for post-secondary education. High dropout and repeat rates are prevalent and place a heavy financial burden on the entire education system. South Africa lacks high-level skills and needs more university graduates, especially in the sciences, engineering and technology (Sedgwick 2004). VUT mostly caters for students who were disadvantaged by the previous education system, subsequently the university has the responsibility to ensure that students receive the best possible learning experience. In order to address past inequities, the type of software used for delivering content must be selected to obtain the highest possible success rate for the profile and diversity of students studying at VUT.

2.3 SELECTION ONLINE MATERIAL

In order to implement online learning for Computer End Using at VUT, it is essential that the learning materials used are of good quality to guarantee student achievement. The goal of any instructional system is to promote learning. Before any learning materials can be selected, educators must understand the principles of learning. This is especially relevant for online learning where the instructor and the learner are separated. The development of effective online learning materials should be based on established learning theories, also referred to as schools of thought on learning (Ally 2004:6). The delivery medium is not the deciding factor for quality learning, and the design of the course is a more important determinant of learning effectiveness (Rovai 2002). There are many schools of thought on learning, but they cannot be used in isolation when developing online learning materials. In the development of online learning materials a combination of the learning theories should be used, so that quality computer literacy training can take place.

Learning strategies, according to Ally (2004), should be selected to:

- motivate students;
- facilitate deep processing;
- build the whole person;
- cater for individual differences;
- promote meaningful learning;
- encourage interaction;
- provide feedback;
- facilitate contextual learning;
- cater for different learning styles and
- provide support during the learning process.

According to the Felder-Silverman Learning Style Model, students may be classified according to the following learning styles (Felder 1996):

- *sensing or auditory learners* (concrete, practical, oriented toward facts and procedures);
- *visual learners* (prefer visual representations of presented material-pictures, diagrams, flow charts) or *verbal learners* (prefer written and spoken explanations);
- *active or tactile/kinesthetic learners* (learn by trying things out, working with others) or *reflective learners* (learn by thinking things through, working alone);

Consideration of the different schools of thought on learning facilitates the identification of characteristics for effective online materials.

2.4 SCHOOLS OF THOUGHT ON LEARNING

Three major approaches to learning have emerged namely, behaviourism, cognitivism and constructivism. All of these schools of thought must be incorporated when designing effective electronic learning materials. Blended online learning theory – as represented in figure 1 is composed of common ground shared between the schools of thought. Within the context of education (and not only technology), blended learning can be seen as a blend of learning theories (Figure 1).

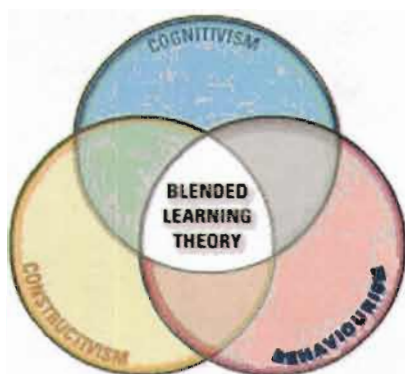


Figure 1: A blend of learning theories

The behaviourist school of thought, influenced by Thorndike (1913), Pavlov (1927), and Skinner (1974), suggests that learning is a change in observable behaviour caused by external stimuli in the environment. Early computer learning systems were designed based on the behaviourist approach to learning. Behaviourists claim that only observable behaviour indicates whether learning has occurred. In response, some educators have argued that not all learning is observable, and that there is more to learning than a change in behaviour. As a result of this, there was a shift away from the behaviourist to the cognitive school of thought.

The cognitive school of thought is based on the premise that learning involves the use of memory, motivation, and thinking, and that reflection plays an important part in learning. The advocates of the cognitive school of thought perceive learning as an internal process, and the amount that the learner learns depends on the processing capacity of the learner, the amount of effort put into the learning process, the depth of processing and the learner's existing knowledge structure (Ausubel 1974).

Recently there has been a move towards constructivism. Constructivists claim that students interpret information and the world according to their personal reality. Students learn by observation, processing and interpretation, and then personalise the information into personal knowledge (Cooper 1993; Wilson 1997).

When these schools of thought are considered, it is apparent that they are not mutually exclusive approaches in terms of ideas and principles. The design of online materials may include principles from all three theoretical approaches. According to Ally (2004), the behaviourists' strategies can be used to teach the "what" (facts), the cognitive strategies can be used to teach the "how" (processes and principles), and the constructivist strategies can be used to teach the "why" (higher level thinking that promotes personal meaning and contextual learning). Janicki and Liegle (2001) analysed different instructional design models to identify the components that support quality design of Web-based instruction. Components were identified from each of the behaviourist, cognitivist and constructivist schools of learning.

2.4.1 Implications for online learning

Each of these schools of thought has principles that can be applied to reach a set of guidelines for effective online materials.

2.4.1.1 Behaviourist School of Learning

The behaviourist school sees the mind as a “black box” in the sense that a response to a stimulus can be observed quantitatively, with no reference to the effect of thought processes occurring in the mind (Atherton 2005). This outlook brings with it the following guidelines for online materials:

- Students should be told the explicit outcomes of learning so that they can set expectations and can judge for themselves whether or not they have achieved the outcome of the online lesson.
- Students must be tested to determine whether or not they have achieved the learning outcome. Online testing or other forms of testing and assessment should be integrated into the learning sequence. For Computer End Using the assessment should ideally be simulation-based to determine if they can use the applications.
- Learning materials should be sequenced appropriately to promote learning.
- Students must be provided with feedback.

Assessment is one of the most critical elements of online learning for two reasons:

- 1) It enables students to experiment with the content they already know to see if they are competent with the content and skills, and
- 2) It measures the effectiveness of all other learning modalities and events.

Bloom (1956) is associated with six levels of cognitive learning, namely knowledge, comprehension, application, analysis, synthesis and evaluation that he defined. In an online learning environment for computer skills, it is desired that the student perform the synthesis and application levels of assessment. The student must be able to apply the acquired knowledge and use the software packages. In order to attain these skills, it is important that the training software and the assessment software offers simulation, where the student can practise in order to learn tasks.

Assessment refers to the process of collecting information about a student's skills in order to make decisions about his/her learning programme. Assessment is a process that should continue throughout a programme and ideally make provision for the following types of assessment:

- Diagnostic assessment – a structured assessment to establish a learner's level of skills and additional support that may be needed. Diagnostic assessment is also referred to as “screening”.
- Formative assessment – a continuous process of review conducted throughout the programme to build up a profile of the individual student and monitor and review his/her progress.
- Summative assessment – a final review of learning at the end of a learner's programme to measure the “distance travelled” (Senet 2004).

2.4.1.2 Cognitive School of Learning

Cognitivists perceive learning as an internal process that involves memory, thinking, reflection, abstraction, motivation and meta-cognition (Wikipedia 2006). Online materials must present the learning materials and use strategies to enable students to process the materials efficiently. Working memory has limited size, thus information should be organised or reduced to smaller portions to facilitate processing. Ally (2004)

has described certain guidelines to incorporate the cognitivist approach; these guidelines are discussed below.

- Strategies should be employed so that students can perceive and attend to information and then transfer it to working memory. Examples include the proper location of the information on the screen, the attributes of the screen (colour, graphics, size of text, etc.), the pacing of information and the mode of delivery (audio, visual, animation, video).
- Online lessons should be clearly outlined to provide a framework for learning so that the student can visualise a learning outcome.
- Prerequisite test questions should be used to activate the prerequisite knowledge structure required for learning the new materials. It is not necessary for students to work through lessons that they have already mastered, before moving on to subsequent lessons.
- Information should be broken down into manageable sections to prevent overload.
- Strategies that require students to apply, analyse, synthesis and evaluate result in higher-level learning that makes the transfer to long-term memory more effective.
- Online learning should include activities for different learning styles.
- In addition to learning styles, adequate support should be provided for students with different learning styles who may have different preferences for support. Information should be presented in different modes to accommodate individual differences in processing and facilitate the transfer to long-term memory. Where possible, textual, verbal and visual information should be presented. According to Webster (2004), high quality online learning material, may constitute the following aspects:
 - high levels of interactivity,
 - vivid simulations,
 - video and/or audio,
 - a community based platform with access to tutors or fellow online learners, and

- links to a learning management system for user progress tracking.
- Students should be motivated to learn and online learning materials should use intrinsic motivation strategies (Malone 1981). Keller (1983) proposed a model for motivating students during learning. This model (ARCS) is based on attention, relevance, confidence and satisfaction.

Attention: Students' attention should be captured at the start of the lesson and maintained throughout the lesson.

Relevance: Students should be informed of the importance of the lesson and how mastery the lesson will benefit them.

Confidence: Students should be informed of the lesson outcome and their confidence should be bolstered by moving from simple to complex concepts.

Satisfaction: Feedback should be provided on performance and students allowed to apply what they have learned in real-life situations.

2.4.1.3 Constructivist School of Learning

Constructivists perceive students as being active rather than passive learners. Knowledge is not received from the outside or from someone else; it is rather the individual learner's interpretation and processing of sensory input that creates knowledge. The learner is the centre of the learning process, with the instructor playing an advising and facilitating role. Students should be allowed to construct knowledge rather than be given knowledge (Tapscott 1998). Constructivism may be viewed as a philosophy where learning is founded on the premise that students construct their own understanding of the world they live in, by reflecting on their past and present experiences. Students generate their own "rules" and "mental models" that they use to make sense of their experiences. Learning is therefore the process where an individual adjusts his/her mental model to accommodate new experiences. Individuals adapt knowledge to accommodate their frame of reference. For education, constructivism is a learning theory, based on the premise that learning is an active process of recreating knowledge, and that knowledge

is not transmitted unchanged from teacher to student. Constructivists teach techniques that place emphasis on the role of learning activities in a good curriculum (Wikipedia 2005). The following guidelines are derived from the constructivist approach (Ally 2004):

- Learning should be an active process. Students, who are kept active doing meaningful activities, are capable of high-level processing.
- Students should be allowed the opportunity to reflect and process the information in a relevant and meaningful way. Embedded questions can further the processing of the lesson content.
- Learning should be made meaningful for students. The learning material should include examples of real life applications for the material learned.
- Learning should be interactive to promote higher-order learning.

2.5 GUIDELINES FOR THE EFFECTIVE IMPLEMENTATION OF ONLINE LEARNING

Based on the theories on education that have been discussed, certain guidelines are suggested for online learning. Merely placing information on the web and linking this to other digital resources does not constitute online instruction. Online instruction occurs when students use the web or a network to proceed through a planned sequence of instructions, complete learning activities, and achieve learning outcomes and objectives (Ally 2002).

The application of learning theories has led five key aspects emerging as important elements for an online learning process (Carman 2002:2):

- Live events – refer to events that are synchronous such as ILT where all students participate at the same time, or a virtual classroom.

- Self-paced learning – The student completes learning activities such as Internet-based or CD-Rom training at an individual pace.
- Collaboration – This is attained by using environments where students communicate with others, such as e-mail or online chat sessions.
- Assessment – is a measure of a student's knowledge. Pre-assessments may be conducted prior to self-paced events, to determine initial knowledge. Post-assessments can be conducted after live or self-paced learning events to measure learning transfer.
- Performance support materials – These are reference materials to enhance learning retention and transfer. This can include PDA downloads, printable references and summaries.

Combining the preceding information, the implications of the different learning theories and the key characteristics of a good online learning model, the nature of online material is essential for the implementation of online learning for Computer End Using at VUT.

The characteristics of an ideal online learning model are described and discussed in the following section.

2.5.1 Live events

Live events refer to real-time communication between the facilitator and students. This communication may be achieved through a virtual classroom or a meeting at the beginning of the programme.

Students who start with Computer End Using require initial instructions in order to log on to the machines, log on to the training material, understand the working of the programme, taking assessments and lessons. This time can be used to provide a rationale to inform students of the importance of the online lessons. Initial training may be

provided verbally at the beginning of the live event or these instructions may be written in the support materials.

2.5.2 Self-paced Learning

- Students should be informed of the explicit outcomes of learning so that expectations can be set and students can determine whether they have achieved the outcome of the online lesson.
- Practice activities with feedback should be included to allow students to monitor their performance and adjust their learning method if necessary.
- Online learning should include activities for different learning styles.
- Appropriate application exercises should be embedded in the online lesson to establish the relevance of the materials.
- Learning should be interactive providing the maximum number of simulations possible.
- Screen layouts and lessons should be user friendly.

2.5.3 Collaboration

Collaboration for an online learning programme for basic computer literacy, is not as critical as for a core online learning course where the student is not present on campus. The computer literacy students are situated on campus and conduct their online learning on campus. The students are divided into groups with scheduled sessions to engage with the material and although these sessions are unstructured, there is ample time for collaboration.

2.5.4 Assessment

- Students should be tested to determine whether expected outcomes have been achieved. This assessment should be integrated into the lessons and provide feedback to the students. Assessment should be simulation-based to stimulate high-level thinking, and encourage the real-life application of the acquired knowledge.
- Pre-requisite test questions should be used to determine prior knowledge.
- Summative tests at the end of the programme should also be used to evaluate the students.

2.5.5 Performance support materials

- Performance support materials, in terms of the screen layouts, should be clearly sequenced and outlined.
- Although performance support is often perceived as one of the most important elements of learning theories, this is arguable in terms of computer literacy training, because the student is acquiring a skill as apposed to theoretical knowledge. It remains necessary to provide the students with a document that describes the importance of taking the course, and provides a schedule for the completion of lessons and also stipulates the dates. It is suggested that students receive a booklet with exercises to perform in real applications such as Word and Excel.
- Opportunities should be provided for students to transfer what they have learned to real-life applications. The use of an extra workbook with exercises for actual applications may be beneficial.

2.6 CONCLUSION

Fundamental computer skills are useful and often essential for tertiary learning and employment opportunities. Computer literacy is defined as the level of expertise and

familiarity a user has with computers. Computer literacy generally refers to the ability to use applications (Webopedia 2004). A perception among VUT lecturers exists that the majority of students enrolled at VUT would not be able to cope with online learning. This study has subsequently been undertaken to determine whether VUT students could be successful users of an online learning programme. According to the South African Qualifications Authority computer literacy is on NQF level 4 (SAQA 2004). Although Computer literacy is regarded as a lower level skill than first year in higher education, it remains a vital prerequisite for completion of tertiary qualifications. Higher education need to offer training for fundamental computer skills so that quality higher learning can be achieved. The National Plan for Higher Education (NPHE) emphasizes the mainstreaming of academic development, this includes the provision of computer literacy training for previously disadvantaged students.

Because of known issues, namely, high dropout rates, low quality of learning and low satisfaction of students, the characteristics and guidelines for the successful implementation of online learning has been investigated to ensure that its implementation at VUT will not have the same problems.

Based on the information obtained from the literature review and a combination of the implications of the different schools of learning, the key components of a good online learning model namely live events, self-paced learning, collaboration, assessment and performance support materials, have been identified.

Online learning is rapidly gaining acceptance as a method for the provision of education and training. Currently there are more than one million online learners worldwide in higher education today (Kistan 2006:157). This has tremendous implications for the quality of teaching and learning and has resulted in attention being given to the evaluation of online learning. Currently, online learning is not a proven process in South Africa and there is much to be gained in assessing the strengths and weaknesses of

online learning. Higher education institutions in South Africa face many complex challenges in an era of restructuring and transformation. Online learning is relatively new to South Africa, but there is an increasing amount of online learning occurring in the traditionally contact institutions. Evaluation is a judgment-forming process that may be applied to activities, initiatives, people, programmes and results (Kistan 2006:157).

The following factors should be taken into account when evaluating software packages for the implementation of online learning for Computer End Using at VUT:

- ease of installation of the packages;
- cost;
- ease of access to the lessons and server;
- recording of results and record management;
- reporting;
- flexibility;
- registering students to use the software;
- student results for assessments.

The following chapter presents a review of literature relevant to online learning of fundamental computing skills.

CHAPTER 3

RESEARCH DESIGN

3.1 INTRODUCTION

In this chapter, the research design that was followed is described and motivated. The selection of software packages, the pilot study and selection of participants is described. The quantitative and qualitative data gathering techniques used are also discussed in this chapter.

The first objective of this study was to develop a set of guidelines for the implementation of online learning for teaching computer literacy (see 1.3). This was done in Chapter 2. The second objective of this study was to benchmark the operational and pedagogical characteristics of two identified software packages, HS Training and SimNet Xpert 3.1 (hereafter referred to as SimNet), with the characteristics of online learning products as identified in Chapter 2 (see 2.5). The third objective was to determine whether a difference in the competence level of students who completed an online course as opposed to students who received Instructor Led Training (see 1.3) can be discerned.

3.2 SELECTION OF SOFTWARE PACKAGES

Two online learning software packages were selected for the empirical study that was conducted during two semesters. Selection of the online learning packages was based on demonstrations that were given at the University by several software vendors.

HS Training was selected because it was the only online learning package for computer literacy that had been developed in South Africa.

SimNet was selected on the basis of the competitive pricing and the comprehensive assessment module (See 2.3) offered by this online learning software package.

3.3 PILOT STUDY

A pilot study was conducted on the two online learning packages, SimNet and HS Training. Lecturers and technicians tested the software, to ensure that it worked correctly, before the students started working on the software packages.

3.4 DESIGN OF THE STUDY

The first package was tested during a single semester and the second package was tested the following semester, with a new / different group of students.

Population and selection of participants:

Approximately 2 500 students from all faculties of the University must complete the Computer Skills course.

Intervention:

A quasi-experimental design was used (see 1.4.2) to divide participants into groups for the pilot study. Quasi-experimental research techniques are appropriate for the evaluation of educational programmes when random assignment is not possible or practical (Gribbons & Herman 1997; Shadish, Cook & Campbell 2002).

The software package used by the faculty of Applied and Computer Sciences to register students for their subjects, was utilised to perform random selection. Using this quasi-experimental design, students were divided into two study groups, by randomly assigning two of the classes to the experimental group (EG) and two of the classes to the

control group (CG). Two classes (the experimental group), completed the syllabus using online learning and two classes (the control group) were taught in the traditional manner through ILT. Each class consisted of approximately 30 students.

Two hours were scheduled on the timetable for both groups of students in the computer laboratories. The EG used both of these hours to work on the online learning package. The CG received lectures and completed some practical exercises from the prescribed book during these two hours. The lecturer to student ratio for both the groups was never more than 1:30. Both groups wrote a “traditional” paper-based test on all three sections of the work (Operating systems, Word Processing, Spreadsheets), that had been scheduled in advance. In addition, the EG also completed a number of online assessments. Although the instructor was available during the scheduled time and during consultation hours for the EG, no active teaching occurred, whereas with the CG the instructor taught for the scheduled two hours. For both groups, no tutors were available in class to assist with problems; the lecturer was available in class in these scheduled times on the timetable. The EG was given an initial training session on how to use the software package. The study was conducted over a period of one semester (six months) for each package.

Data gathering

Two types of data were obtained from the empirical study of the EG and CG, namely qualitative and quantitative data. The quantitative data was based on the results students obtained after completing the online and paper-based assessments. Qualitative data was gathered by means of observations made during the experimental groups’ use of the software package throughout the semester.

Observation of staff and students

Observation is a data gathering technique where the researcher collects data by patiently observing the research subject (Wordnet 2006). The researcher made observations while students were using the packages. Aspects that were included in these observations were ease of use, problems encountered, price, reporting, etc. as perceived by the researcher and /or reported by the students.

Test results

Students in the EG completed three online summative assessments and three written summative assessments. Students in the CG only completed the three written summative assessments. Students in the CG did not complete the online assessments, as they were not registered on the system to access these assessments.

In the first part of the study students in the EG completed the assessments that form part of the SimNet package. In the second part of the study, where HS Training was used, the online assessments taken by the EG were derived from the assessment module of SimNet, as HS Training does not offer an assessment module to use. Students in the EG worked through the lessons in the HS Training package and then took the online assessment tests provided by the SimNet package.

The written assessments of both groups and the online assessments of the EG were collated so that a dataset could be compiled. The data obtained from the empirical study was analysed to determine whether online assessment results were satisfactory. Further data analysis was conducted in order to establish whether students actually mastered the content of the programme. The results which students obtained in their assessments while using these two packages were compared, in order to reach a further recommendation as to which of these two packages will be the preferred package for VUT to use.

3.5 CONCLUSION

This chapter has presented the research design that was followed to guide the empirical study. The focus of this chapter was to describe the empirical process followed for the selection of an online computer literacy training software package and application within a quasi-experimental design.

The pilot study, population and random assignment of participants have been described. The international package (SimNet) was used during the first semester, and a locally developed package (HS Training) was used during the second semester. Students were divided into experimental and control groups (see 3.3). The packages were evaluated by observations made, and a statistical analysis was performed on the results obtained by students for their assessments throughout the semester.

Two types of data, namely qualitative (observation based) and quantitative data (results obtained during assessments) was obtained through the application of the research design.

The research results of the study are covered in the following two chapters. Chapter 4 reports on the results of the observations made, while Chapter 5 will cover the statistical analysis performed on the quantitative data.

CHAPTER 4

SOFTWARE PACKAGES FOR THE ONLINE OFFERING OF COMPUTER LITERACY

4.1 INTRODUCTION

The literature review, presented in Chapter 2, provided guidelines for the selection of high-quality online learning software material. The previous chapter discussed the research design and this chapter evaluates two software packages that can be used to teach computer literacy. An evaluation will be conducted in order to make an informed and justified decision with regard to selection of a package to use in practice at VUT, and to eliminate poor quality programmes in future as well. The guidelines that were presented in Chapter 2 will be used to evaluate the software packages in terms of the provision of high quality online learning material.

The two software packages are SimNet Xpert version 3.1, an international developed product, and HS Training, a programme developed in South Africa. The criteria that will be used to evaluate these software packages are the five key elements for online learning that were set in Chapter 2 (see 2.5.1). The elements are live events, self-paced learning, collaboration, assessment and performance support materials.

4.2 EVALUATING THE ONLINE LEARNING PACKAGES

Different viewpoints exist regarding the make-up of quality learning. In South African higher education, quality encompasses three elements, namely fitness for purpose, value for money and transformation (HEQC 2001:14). As mentioned in Chapter 2, educational outcomes – rather than mode of delivery – should be used as criteria for evaluating the quality of online learning programmes (Clark 1983). It is widely accepted that the

quality of online learning can be measured by the degree to which stakeholders' needs and expectations are consistently satisfied (White 2001). The criteria formulated in Chapter 2 will be used to organise the observations made throughout the study and are described in the following section.

4.2.1 Live events

- **Communicating with students in real-time (see 2.5.1)**

Both software packages cater for similar live events. Live events are activities that the instructor has to initiate. The only live event that occurred with the implementation of these packages was the initial training session to instruct the students on the use of the packages; how to log on to the computer and how to perform the assessments. At this stage it is not possible to make a distinction between the packages with regard to real-time communication.

4.2.2 Self-paced learning (see 2.5.2)

- **Students should be informed of the explicit outcomes of learning so that expectations can be set and students can form their own opinions whether the outcome of the online lesson has been achieved.**

SimNet: On opening, each lesson has a heading that shows the topic of the current lesson, this is depicted in Figure 2 overleaf. Each lesson contains a *Teach Me* and a *Let Me Try* section to provide students with the opportunity to implement what has been learned and to determine whether the outcome of the lesson has been achieved.

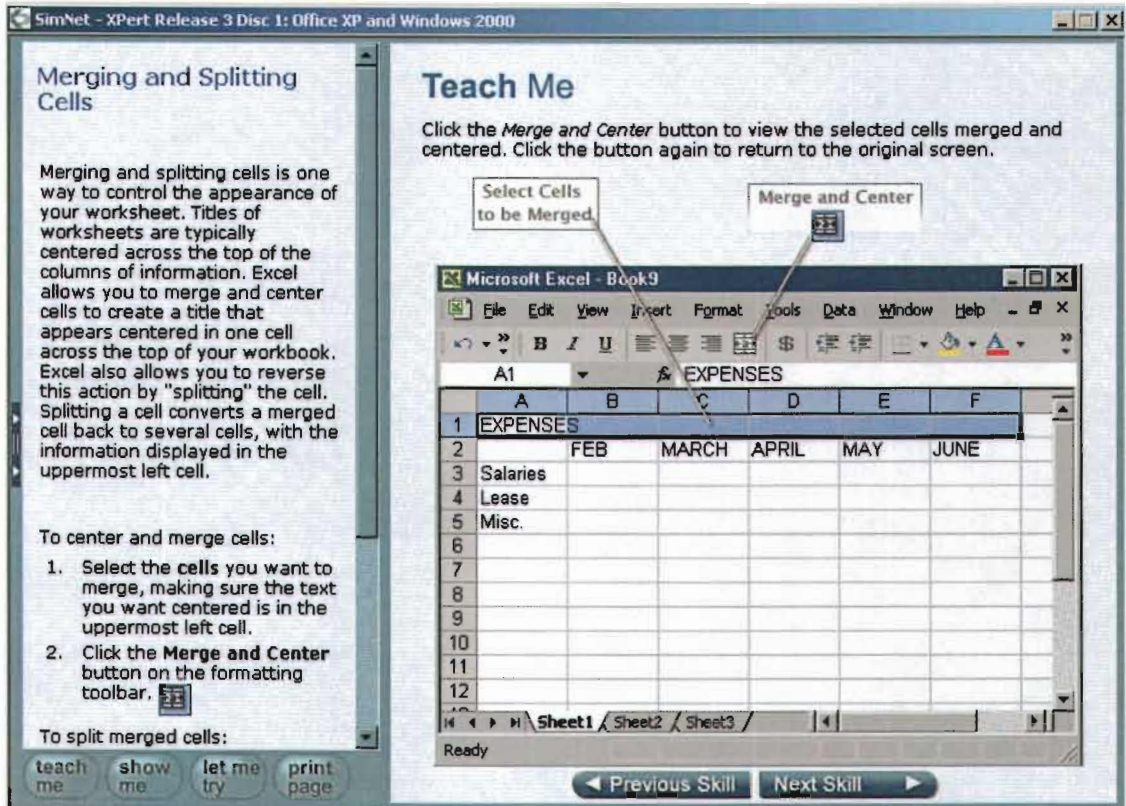


Figure 2: *Teach Me* lesson in SimNet

HS Training: Each lesson continues from the previous lesson without informing the students of the precise activity they are busy with. Opportunities to practise what has been learned appeared on certain pages, but not all. Figure 3 depicts an HS Training page that does not offer the opportunity to practise a lesson.

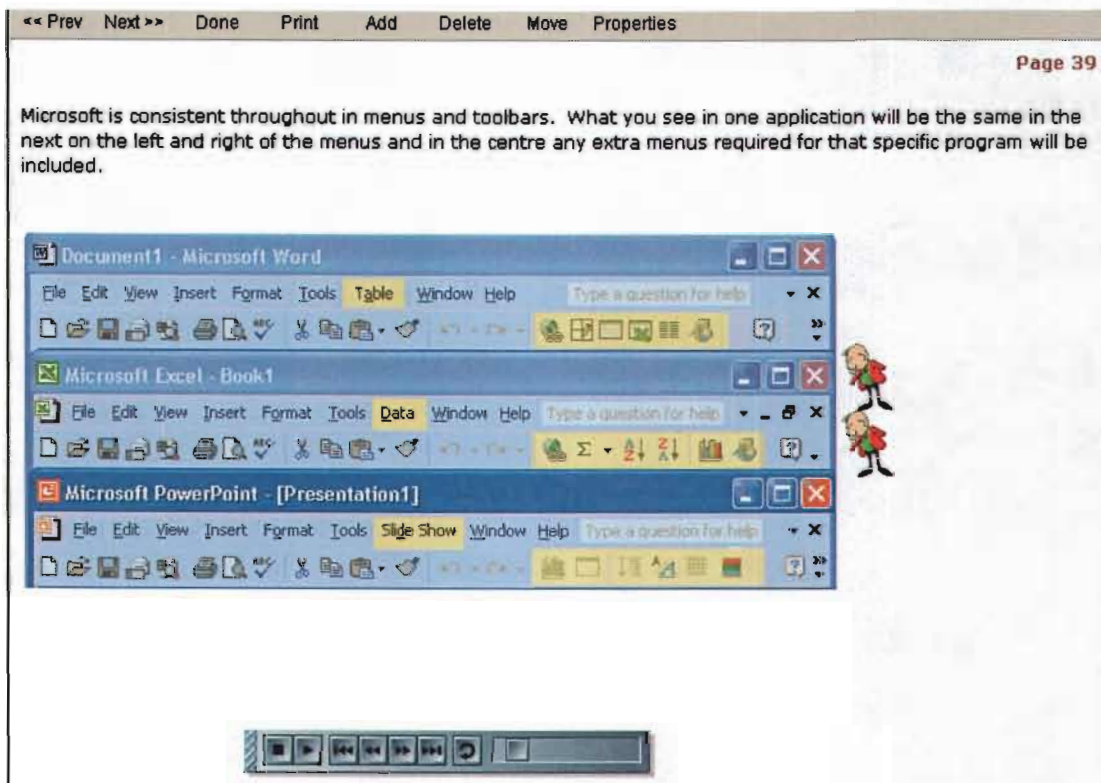


Figure 3: A lesson without a *Let Me Try* section in HS Training

- **Practice activities with feedback should be included to allow students to monitor their performance in order to adjust their learning method if necessary.**

SimNet: Each lesson has a *Let Me Try* section that allows students to try the activity on their own as indicated in Figure 4. If a particular student is struggling with an activity, a hint box pops up to guide the student in order to be able to complete the activity.

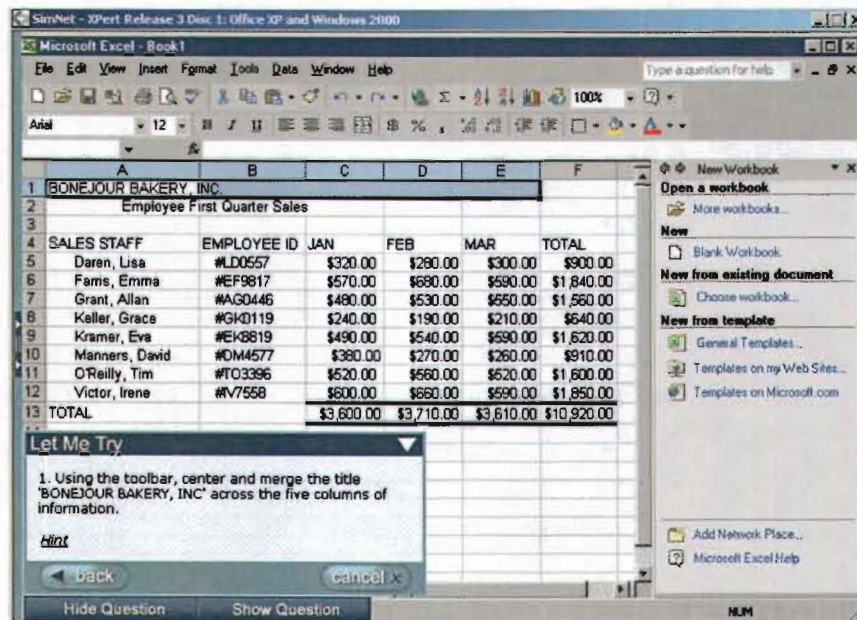


Figure 4: An Example of the *Let Me Try* section of the training in SimNet

HS Training: There are some activities built into the lessons for students to attempt individually, but these activities are not as frequent as in SimNet. Students often need to browse through a number of reading pages before they encounter a “Try” button (Figure 5).

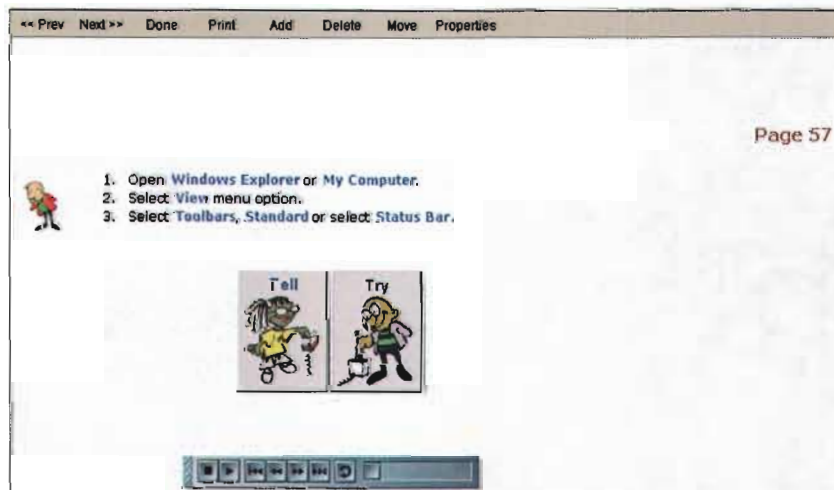


Figure 5: Lesson with a *Let Me Try* section in HS Training

The “Try” section provides feedback on how an activity should be done, although not in as much detail as found with the SimNet package (Figure 6).

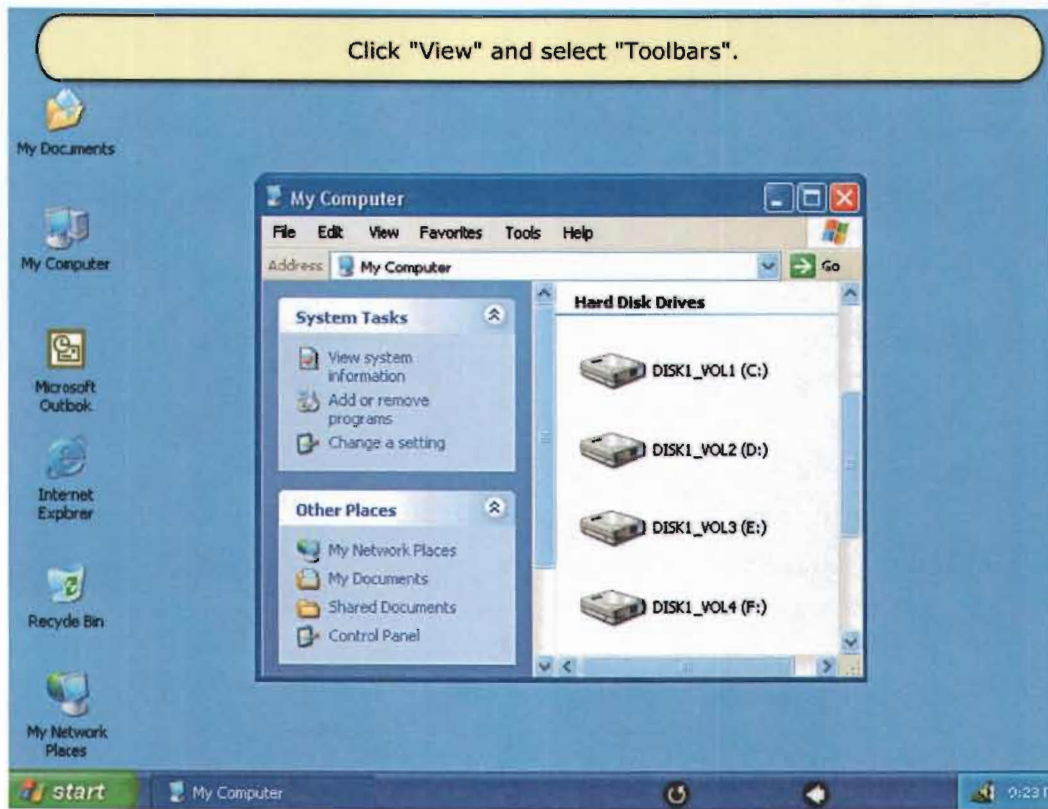


Figure 6: Example of feedback in HS Training

- **Online learning should also include activities for different learning styles.**

SimNet: Every lesson (page) in this package contains a *Teach Me* (Figure 7) section where students can read through the explanation. There is also an option for students to print out a particular page if desired. This caters for visual students (see 2.3) who learn through seeing.

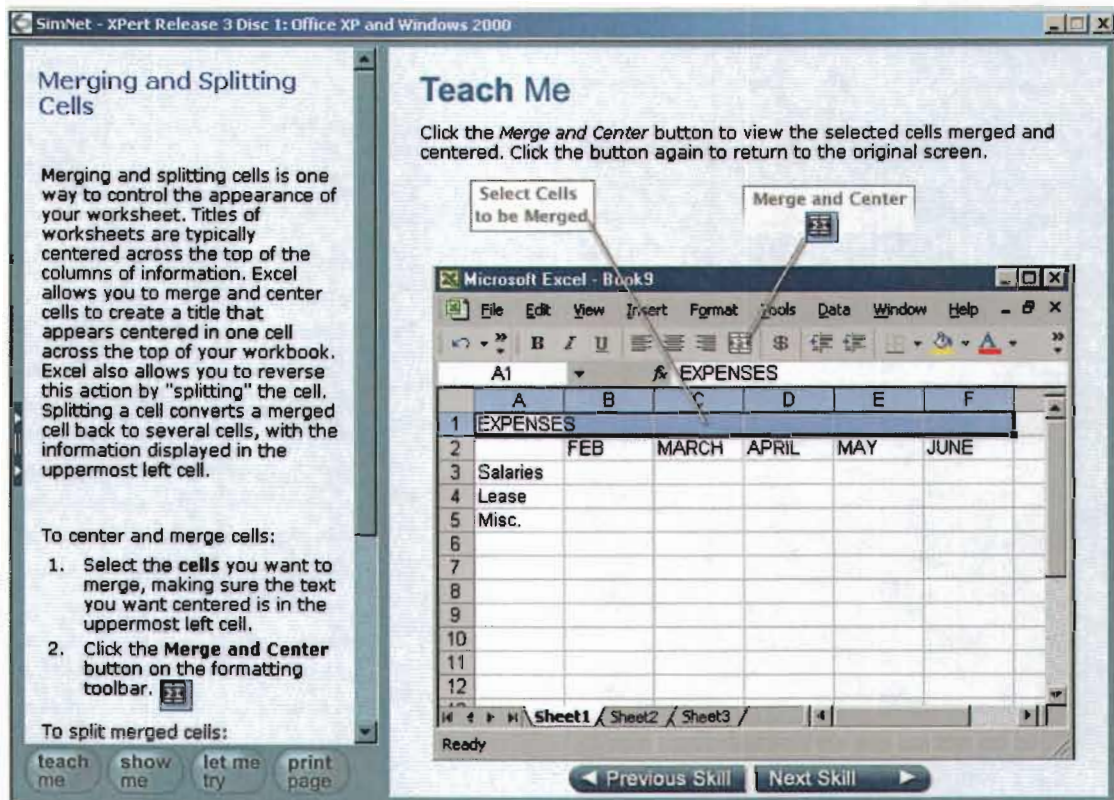


Figure 7: An example of a *Teach Me* section in SimNet

Together with the *Teach Me* section there is also a *Show Me* section (Figure 8) on every page in SimNet. Animations are included to show students where to click with the mouse, which menus to open, etc. There is also a soundtrack in this section, so that students can listen to an explanation of the section. This is thus suitable for auditory students (see 2.3) who learn through listening.

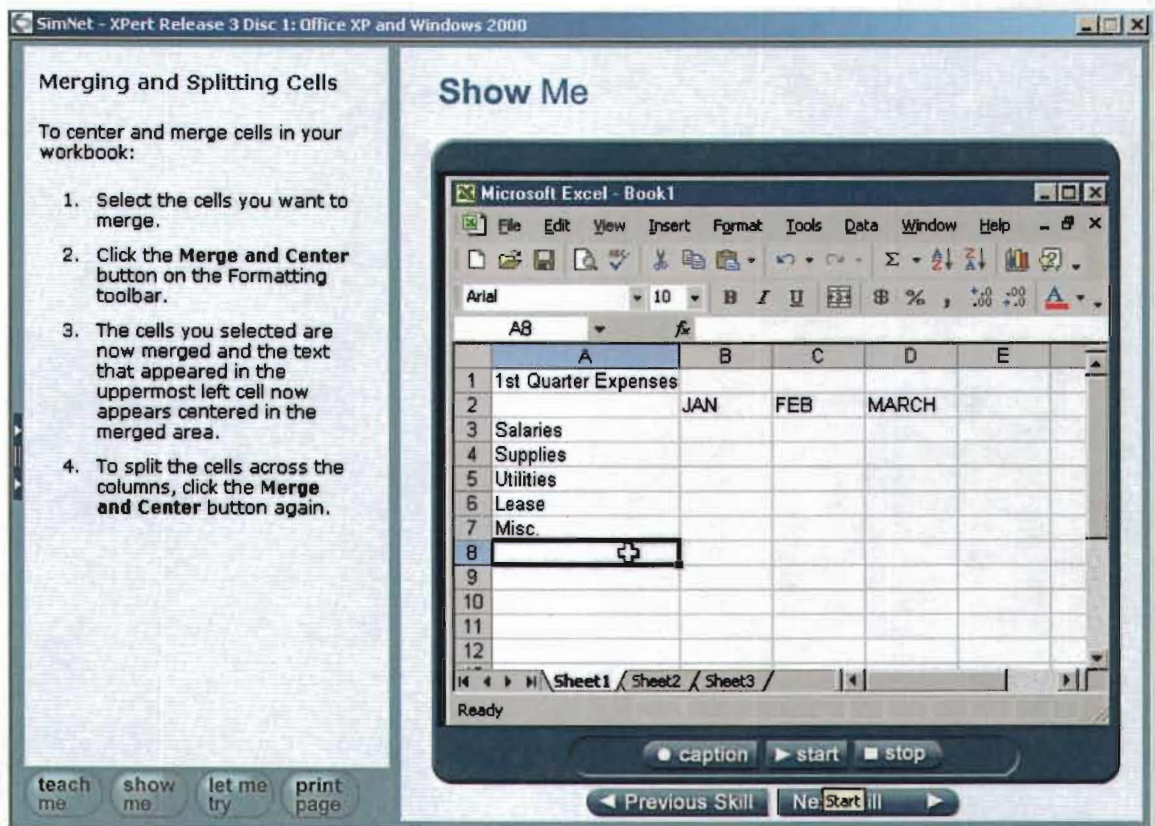


Figure 8: An example of a *Show Me* section in SimNet

SimNet further offers a *Let Me Try* (Figure 9) option for every topic of the work. The students are given questions or tasks to perform individually, with hints the student can hide or show. This option caters for the tactile/kinesthetic students (see 2.3) who learn through moving, doing and touching.

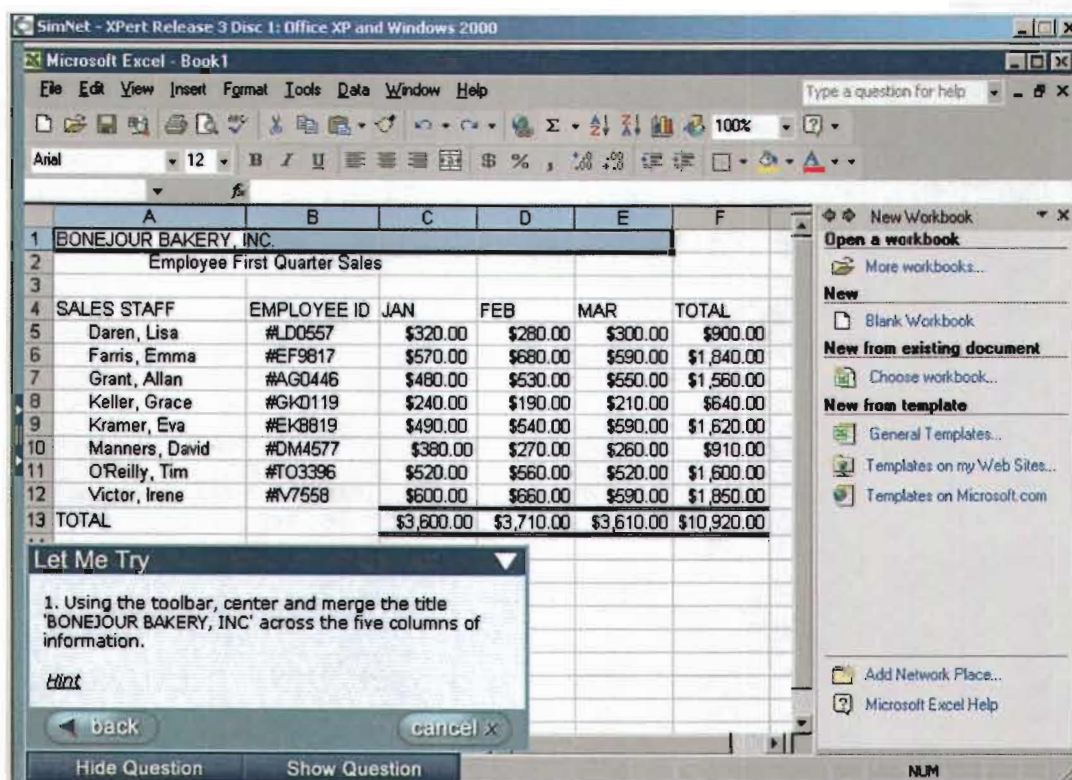


Figure 9: An example of a *Let Me Try* section in SimNet

HS Training: This package caters mostly for students who prefer a visual and auditory style of learning (see 2.3). Each page includes a soundtrack, so that the student can listen to the text while reading it simultaneously (Figure 10). A large amount of reading is required and a “Show” or “Try” button is not encountered on every page. This package does include certain elements for the Tactile/Kinesthetic students (see 2.3), but not to the same extent provided by SimNet.

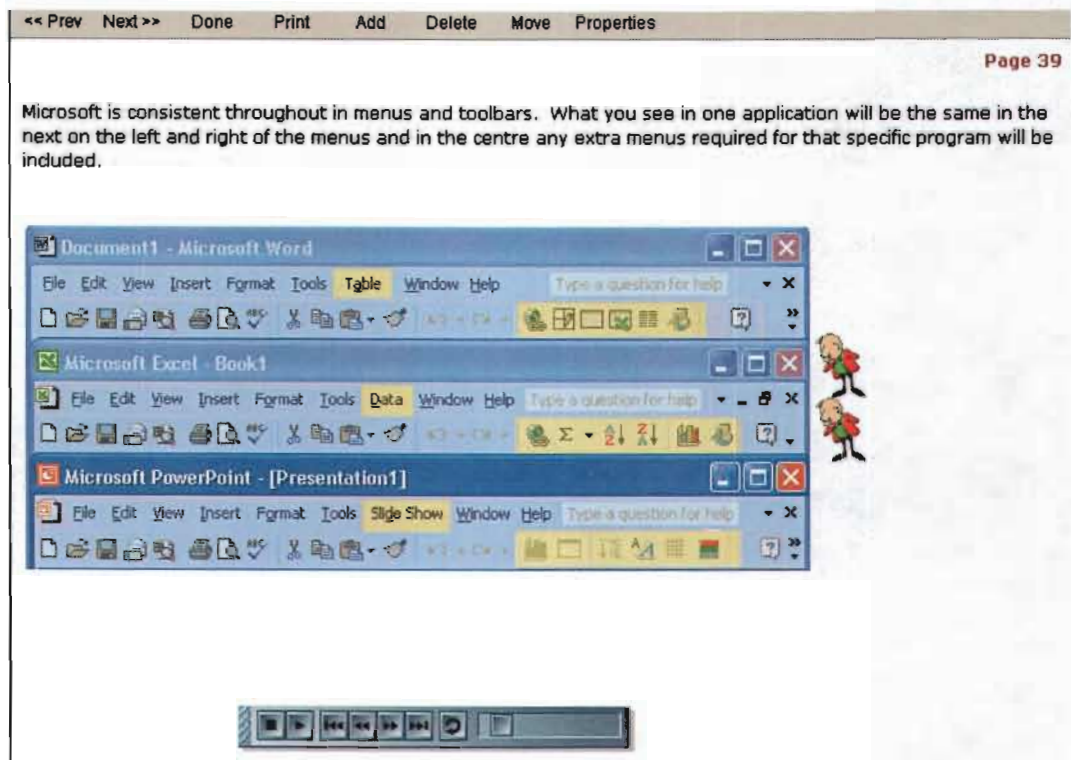


Figure 10: Lesson with reading and soundtrack

- **Appropriate application exercises should be embedded throughout the online lesson to establish the relevance of the materials.**

SimNet: An application exercise is embedded in every topic, a *Let Me Try* section is found on every page of every lesson.

HS Training: Not all lessons have an embedded application exercise for the student to complete. Embedded applications are only found on only certain pages of the lessons.

- **Learning should be interactive and simulation-based.**

SimNet: Learning with this package is very interactive. The student can read through the lesson, *Teach Me*, then view a simulation on performing the activity, *Show Me*, and then the student is given the opportunity to try the activity on his/her own, *Let Me*

Try. It must be noted that these three sections consistently appear every page of the lessons, without exception.

HS Training: There are interactive elements in this package, but not as extensive as the interaction offered by SimNet. The student encounters a “Tell” or “Try” button to activate the simulations, on a limited number of pages in the HS Training package.

- **User Friendliness**

SimNet: This package requires less reading and offers more practical application. This is especially beneficial for students who have limited competence with the English language.

HS Training: There is a large volume of reading required on every page of the lessons. This can be demotivating for students who are not competent in English.

4.2.3 Collaboration

Online collaboration (see 2.5.3) was not regarded as a high priority for this study, due to the scheduled sessions in a laboratory where the lecturer was present. For this programme, students used online learning for a single subject and not for their whole course. Collaboration was not viewed as a vital factor for this study as opposed to an online learning course where the student is not present on campus, and collaboration becomes essential.

4.2.4 Assessment

- **Students should be tested to determine whether outcomes have been achieved. This assessment should be integrated into the lessons and provide feedback to the student. It should further be simulation-based to stimulate high-level thinking, and to make it appropriate for real-life applications of what has been learned.**

SimNet: The primary advantage of this package lies in its assessment module. Assessments (see 2.5.4) are built into each lesson in the form of a *Let Me Try* section. Feedback is given to the student so that he/she knows what was done incorrectly (Figure 11). All these exercises are performed in a simulated environment that appears and acts just as the real application would, making it simple to apply this knowledge to the real world.

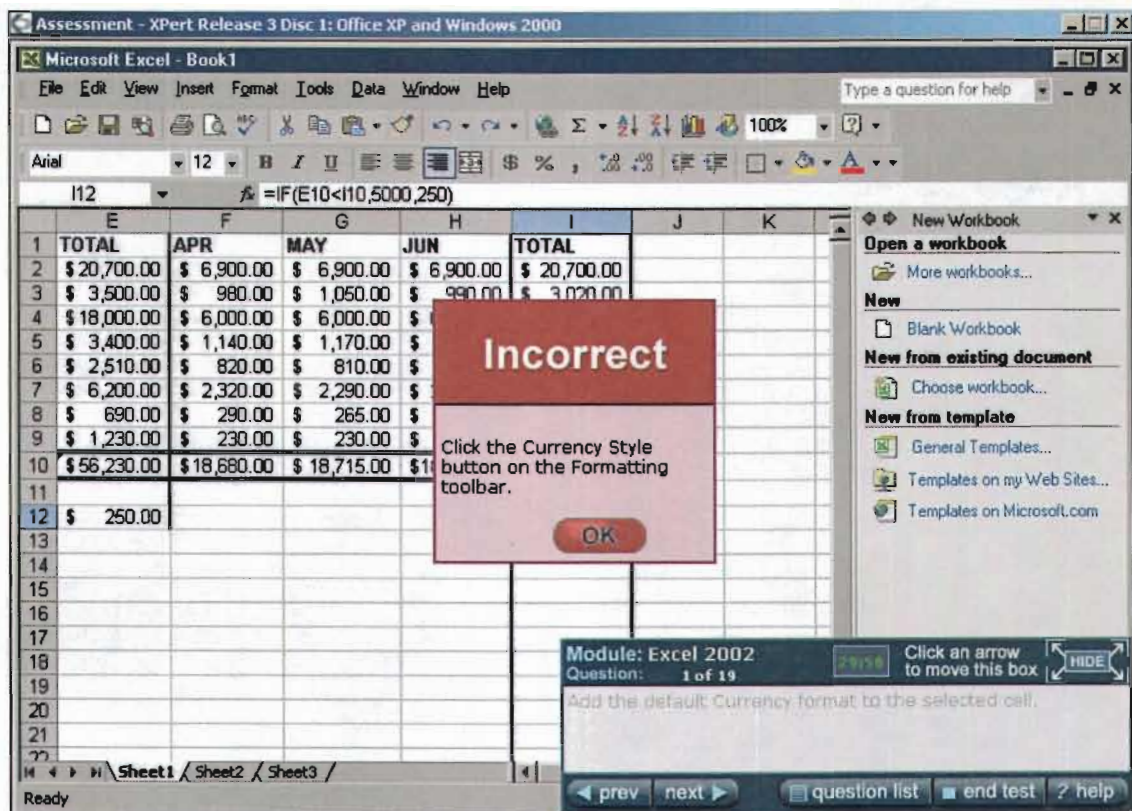


Figure 11: Example of feedback given in SimNet

HS Training: According to the first three criteria, the two packages appear to be on equal level. However, in terms of assessment HS Training lags behind. No real opportunities for diagnostic, continuous or formative assessments are provided. The only tests that can be taken repeatedly are multiple choice tests,

that do not test the skills of the student. Feedback is given after the multiple choice test has completed and not after each question (Figure 12).

Your assessment results:

Total mark for assessment	9 out of 12 = 75.0 %
Correct answers	9
Incorrect answers	0
Unanswered questions	0

General feedback:

Thank you for completing this assessment!

Feedback on your answers:

Question 1

When typing, what keys must you press to type the %? Select the correct position.

	Possible Answers	Score	Result
You Selected	Shift + 5	1	✓
Feedback	Your answer is correct!		
Other Possible Options	Caps Lock + 5	0	✗
	Ctrl + 5	0	✗

Figure 12: An example of feedback in HS Training

- **Prerequisite test questions should be used to determine prior knowledge.**

SimNet: This package contains many standard assessments, and the instructor has the option to build customised assessments for a specific group of students. Any of these can be used to determine prior knowledge before the student begins with the lessons. Although it would be ideal if the lessons given to the student were based on the outcome of the assessment, the student determine what lessons can be skipped according to the outcome of the assessment.

HS Training: Prerequisite tests are done as multiple choice tests, and are not appropriate for this practical subject. The lecturer is not able to develop a customised test for a specific group of students.

- **Summative, end of programme tests must also be given to grade students.**

SimNet: Standard or special built tests can be given as summative assessments. Options that can be set for these tests include: the length of the test, the timeframe for completion by students and the number of times the test can be taken by the student.

HS Training: No specific summative tests were available. This is a distinctive drawback as assessment is an essential element of quality online learning.

4.2.5 Performance support materials

- **Performance support materials (see 2.5.5) for screen layouts should be sequenced and outlined clearly.**

SimNet: The layouts of the screens in SimNet are logical and easy to understand. Each lesson looks the same and presentation is consistent. A tree structure allows the student to navigate different lessons and to view completed lessons and remaining required activities.

HS Training: The layout is easy to work with, and also has a tree structure for navigation of lessons and work to be undertaken.

4.3 FURTHER EVALUATION

Aspects not covered by the aforementioned elements of quality online learning materials are depicted in the following comparison (Table 1 – Table 3). The table

covers issues such as installation of the packages, pricing, ease of access, recording of results and reporting. This comparison clearly shows that SimNet is clearly the most acceptable of the two packages.

Table 1: Installation, pricing and access comparison between SimNet and HS Training



 SimNet XPert 3.1	 HS Training
<u>Installation</u>	
<p>Software was installed by VUT staff.</p> <p>Software must be installed on each station and the server, which initially makes SimNet more labour intensive.</p> <p>Some problems with the installation were encountered. Support was done through e-mail, and an approximate 12-hour delay in response time was experienced, due to the different time zones. However, good support was provided.</p>	<p>HS Training staff installed software on the server.</p> <p>No installation is necessary on workstations.</p> <p>Support was provided online. HS staff logged onto the server and downloaded the patches needed to solve certain problems, for example, certain of the practical exercises did not work.</p>
<u>Pricing</u>	
<p>\$24 per student (at current exchange rate: ±R146).</p> <p>Includes:</p> <ul style="list-style-type: none"> • Computer concepts. • Introductory courses for Word, Excel, Windows 2000, Access, Powerpoint, Frontpage, InternetExplorer, Windows XP, and Office XP Integration. • Intermediate courses for the abovementioned applications. • Advanced courses for the abovementioned applications. • Assessment. 	<p>R210 per student.</p> <p>Includes:</p> <ul style="list-style-type: none"> • Computer concepts. • Introduction courses for Word, Operating systems and Excel. • Assessment (Only multiple choice questions at the time of software utilisation).
<u>Access</u>	
<p>The workstation gains access to the shared data through a mapped drive to the server on a LAN.</p>	<p>Workstations have no software for the package loaded. All data and the program are accessed through an URL to a web server.</p>

Table 2: Administrative support for facilitators provided by SimNet and HS training



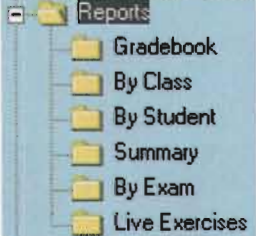


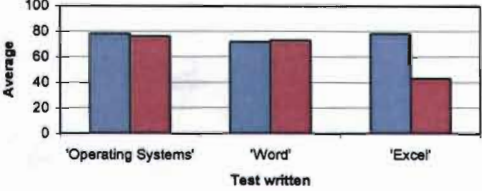
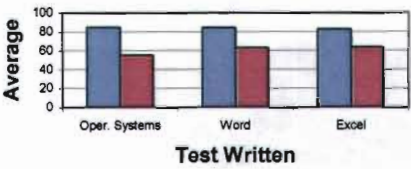
 SimNet XPert 3.1	
<u>Results recording</u>	
<p>Results are recorded on the server. Results can be converted to comma delimited Excel files (.csv), and thus also to txt files for exporting to the LMS (Learner Management System) used by the University.</p>	<p>Results are recorded directly onto the LMS (Learner Management System).</p>
<u>Reporting</u>	
<p>Different reports can be drawn, for example, according to class, according to student, etc.</p>  <p>Additionally reports on the topic and the number of times a student has completed a lesson can be compiled.</p>	<p>Can only report on the results of a certain test and provide a direct list of results for a particular test without being able to specify any details.</p>
<u>Registering students</u>	
<p>The Instructor can register students. A new student can start working immediately.</p>	<p>Registering of students is done externally on the LMS. A new student's information has to be phoned or e-mailed through to the LMS personnel; it can be that a new student will only be able to start working the next day.</p>
<u>Flexibility</u>	
<p>The instructor can change standard lessons to suit the class, for example to include something from the intermediate lessons into a core lesson, or to omit certain topics from lessons for students.</p> <p>The Instructor can set up specific tests, with specific preferences.</p> <p>A student can continue to the intermediate and advanced lessons if finished with the core lessons. Students have the advantage of delving deeper, and working at individual pace.</p>	<p>No changes to lessons can be made.</p> <p>No changes of tests can be made.</p> <p>The license VUT used only catered for the introductory courses.</p>

Table 3: Comparison of assessment provided by SimNet and HS training

 SimNet XPert 3.1	 HS Training																								
<u>Assessment</u>																									
<p>Assessment (see 2.5.4) is done by means of simulation, and is possibly the greatest advantage of this package. The assessment tool is excellent.</p>	<p>Only multiple-choice questions are provided.</p>																								
<p>The instructor can alter the test and preferences (time limit for test, how many times a question can be tried, the kind of feedback given, etc.) for an assessment.</p>	<p>Tests are fixed and cannot be changed at all by the instructor.</p>																								
<u>Student results</u>																									
<p>The following graphs presents a comparison of the group average for the students using the online learning software, and the students who received formal training from a lecturer. (ILT-Instructor Led Training). For both semesters the SimNet assessment tool was used, including for students who trained on HS Training, because HS Training does not provide an assessment module.</p>																									
<p style="text-align: center;">Comparison of averages for ILT students vs students using SimNet</p>  <table border="1" data-bbox="331 1115 815 1305"> <caption>Comparison of averages for ILT students vs students using SimNet</caption> <thead> <tr> <th>Test written</th> <th>ILT students (Average)</th> <th>Students using SimNet (Average)</th> </tr> </thead> <tbody> <tr> <td>'Operating Systems'</td> <td>~78</td> <td>~75</td> </tr> <tr> <td>'Word'</td> <td>~72</td> <td>~72</td> </tr> <tr> <td>'Excel'</td> <td>~78</td> <td>~42</td> </tr> </tbody> </table>	Test written	ILT students (Average)	Students using SimNet (Average)	'Operating Systems'	~78	~75	'Word'	~72	~72	'Excel'	~78	~42	<p style="text-align: center;">Comparison of averages for ILT students vs students using HS Training</p>  <table border="1" data-bbox="882 1137 1294 1305"> <caption>Comparison of averages for ILT students vs students using HS Training</caption> <thead> <tr> <th>Test Written</th> <th>ILT students (Average)</th> <th>Students using HS Training (Average)</th> </tr> </thead> <tbody> <tr> <td>Oper. Systems</td> <td>~82</td> <td>~58</td> </tr> <tr> <td>Word</td> <td>~82</td> <td>~62</td> </tr> <tr> <td>Excel</td> <td>~82</td> <td>~62</td> </tr> </tbody> </table>	Test Written	ILT students (Average)	Students using HS Training (Average)	Oper. Systems	~82	~58	Word	~82	~62	Excel	~82	~62
Test written	ILT students (Average)	Students using SimNet (Average)																							
'Operating Systems'	~78	~75																							
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Test Written	ILT students (Average)	Students using HS Training (Average)																							
Oper. Systems	~82	~58																							
Word	~82	~62																							
Excel	~82	~62																							
<p>Students performed very similarly to students receiving lectures in a classroom (ILT-Instructor Led Training), except for Excel, where the students achieved considerably lower test scores, in comparison with the ILT students.</p>	<p>Students using HS Training obtained lower test scores overall for all the sections of the work than those who received "traditional" lectures.</p>																								
<p>6 students (11.5 percent of the group) using the SimNet 3.1 software package were not successful in the course (a year mark was formed by calculating the average of all summative assessments done throughout the semester).</p>	<p>22 students (25 percent of the group) using the HS Training software package were not successful in the course (a year mark was formed by calculating the average of all formative assessments done throughout the semester).</p>																								

4.4 SUMMARISED COMPARISON

A summary of the criteria for quality online learning with regard to SimNet and HS Training is presented in the following section.

Live events (see 2.5.1)

For this criterion the two packages were considered to be relatively similar. Both packages address this matter sufficiently and neither can be singled out as being superior.

Self-paced learning (see 2.5.2)

Examination of this aspect shows that SimNet addresses a number of matters more appropriately than HS Training. The layout and user friendliness of the package is better, feedback is substantial and frequent, and students can assess whether they are able to do the work on every page; this is not the case in HS Training.

Collaboration (see 2.5.3)

Collaboration was not an appropriate criterion for this study, as students only had access to the study material in the computer centre, and not from home. Subsequently no distinction could be made in this regard between the software packages.

Assessment (see 2.5.4)

With regard to assessment SimNet stands out head and shoulders above HS Training. Its assessment module is interactive and builds on simulations. HS Training only has multiple-choice questions that are totally unsuitable for the assessment of a practical skill such as using the computer.

Performance support materials (see 2.5.5)

In terms of the provision of performance support materials neither package could be singled out, both packages do not provide additional support materials to supplement the electronic learning system.

4.5 CONCLUSION

Online learning has not to date proven to be successful in South Africa and there is much to be gained by assessing the strengths and weaknesses of online learning. The higher education landscape in South Africa faces a number of complex challenges in an era of restructuring and transformation. Online learning is relatively new to South Africa but an increasing amount of online learning occurs on the campus grounds of traditionally contact institutions. Online learning packages should be evaluated before an informed decision regarding implementation can be made. Evaluation is a judgment-forming process that may be applied to activities, initiatives, people, programmes and results (Kistan 2006).

In this chapter, two software packages used for online learning were evaluated to determine the quality of learning offered by these packages and to select the most suitable package. Based on the five key elements identified in Chapter 2, it was seen that SimNet was the more suitable package to be installed at VUT for self-paced learning and assessment. The other three key ingredients (live events, performance support materials and collaboration) did not differentiate between the two packages; both of the packages performed the same for these criteria.

On the basis of the comparison that has been made, SimNet is therefore recommended as being more acceptable for students at VUT to use.

CHAPTER 5

STATISTICAL ANALYSIS OF THE RESULTS OBTAINED BY STUDENTS

5.1 INTRODUCTION

In the previous chapter two online learning packages, used by VUT students for Computer End Using were evaluated and compared, by utilising the criteria that were identified in Chapter 2 (see 2.5).

In this chapter, the results that students obtained (quantitative data) in their assessments while using these two packages are used. An analysis of this quantitative data is presented so that further recommendations with regard to selection of the preferred package for VUT to use.

5.2 ANALYSIS OF THE RESULTS OBTAINED IN SIMNET

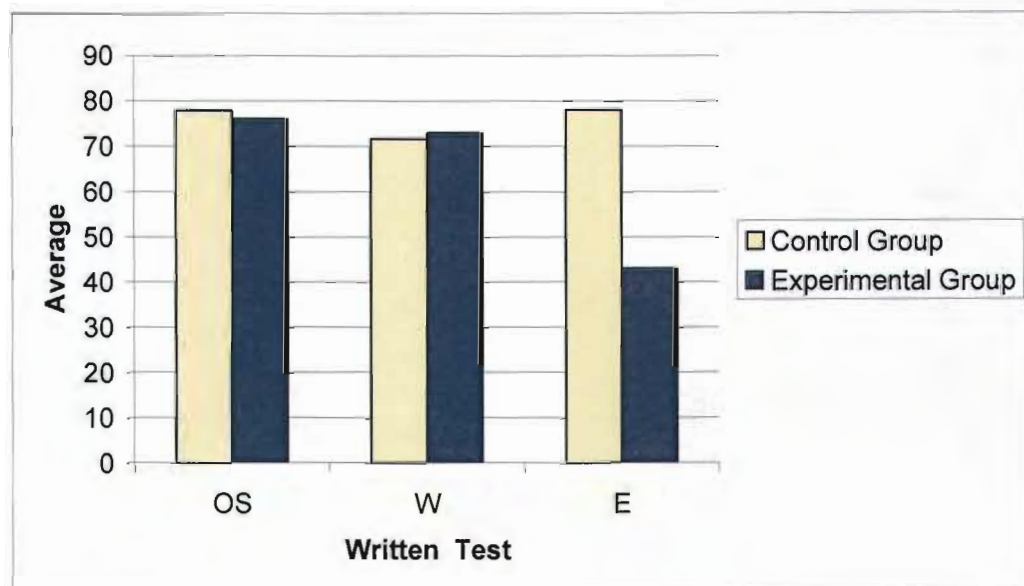


Figure 13: Comparison of averages for the experimental group and the control group for the Operating Systems, Word Processing and Spreadsheet sections

In Figure 13 the averages of the control group for three sections of the work, Operating Systems (OS), Word (W), and Excel (E), were compared to the averages of the written tests for the experimental group. For Operating Systems and Word the experimental group and the control group performed the same. It may be deduced that the online package used sufficiently explained these two sections of the work. The students who worked through the online lessons and the students who received Instructor Led Training performed the same, this indicates that the online learning was adequate.

For Excel the experimental group achieved substantially lower marks than the control group. One reason for this could be that in Excel, the use of formulas and functions are on a higher cognitive level and require more explanation than for Operating Systems and Word. It appears that online learning has not addressed this aspect adequately. A blended learning approach should be considered for the spreadsheet section of the work.

In the scatter plot graphs that follow, the correlation coefficient (Easton & McColl 2005), is calculated to determine if there is a correlation between the online assessment and the written assessment of the students of the experimental group. If a positive correlation is found, the student who performed well in the written assessment will probably also perform well in the online assessment. The conclusion may be reached that, if a student performed well in the online assessment, this student has mastered the programme.

The correlation coefficient in Figure 14 is 0.5. With the four largest outliers deleted as in Figure 15, the correlation coefficient changes to a significant 0.7. Possible causes for these outliers may include poor class attendance, poor English language proficiency, or even personal problems. The assumption can thus be made that, if a student performed well in the online assessment, it is an indication that he/she mastered the Operating Systems section of the programme.

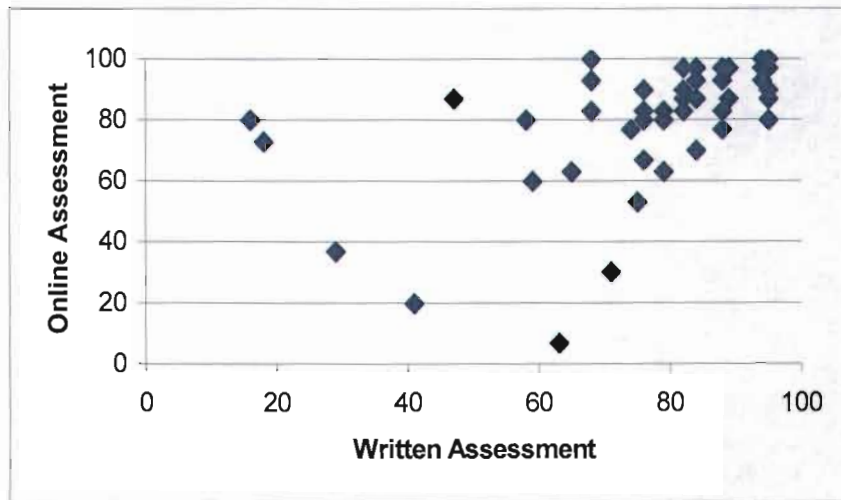


Figure 14: Scatter plot of correlation between the online assessment and the written assessment of the Operating Systems section

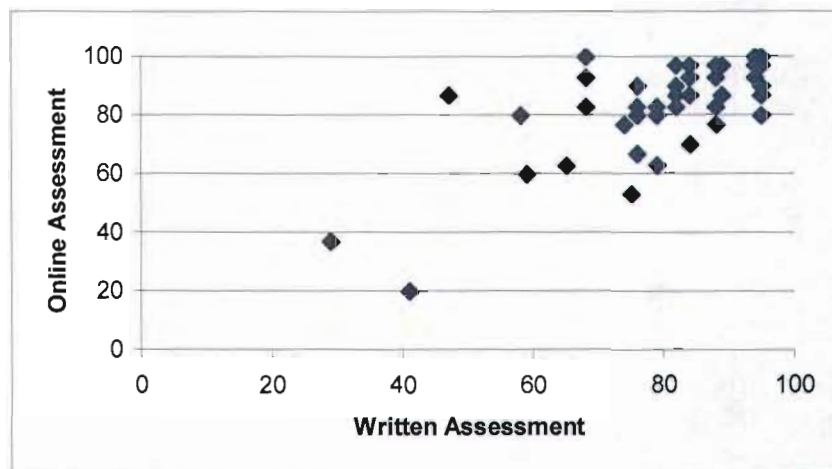


Figure 15: Scatter plot of correlation between the online assessment and the written assessment of Operating Systems with biggest outliers deleted

The same procedure applied for Operating Systems (depicted in Figure 14 and Figure 15) was followed for the Word assessment, and the correlation coefficient for the population is 0.6. With the five largest outliers deleted, the correlation coefficient

changes to 0.7. Again the assertion can be made that, if a student performs well in the online assessment, it is an indication that he/she mastered the Word section of the programme.

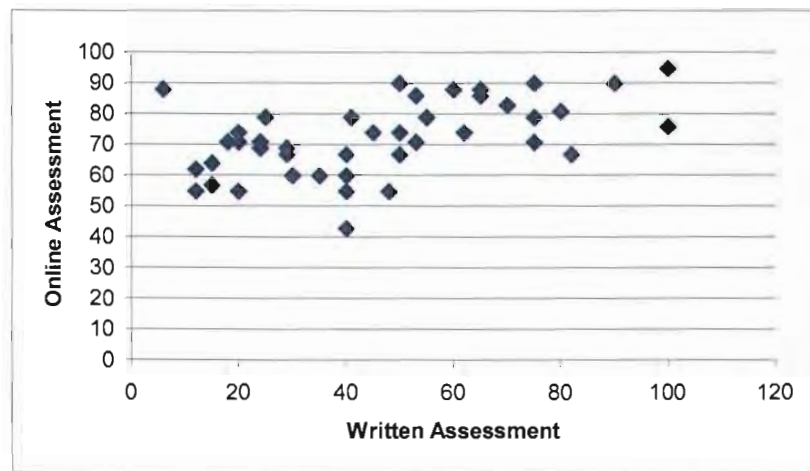


Figure 16: Scatter plot of correlation between the online assessment and the written assessment of the Spreadsheet section

The correlation coefficient for the Excel written and online assessment is 0.5 (Figure 16), with not as many distinctive outliers. The distribution lies towards the lower marks area for the written assessment. This indicates that a student who performed well in the online assessment did not necessarily perform well in the paper test. It cannot be said that a good result for the online test indicates a mastery of the subject section.

The following three interval graphs determine the validity of the tests that were written. In theory, an interval graph is a graph that captures the intersections among a set of intervals on the real line (Wikipedia 2006). The number of students, whose results fell within each interval of marks, were calculated for the written and online assessments. These frequencies were then plotted on an interval graph. If the online assessment and the written assessment give the same distribution, the tests can be seen as valid.

The following legends will be used for the interval graphs:

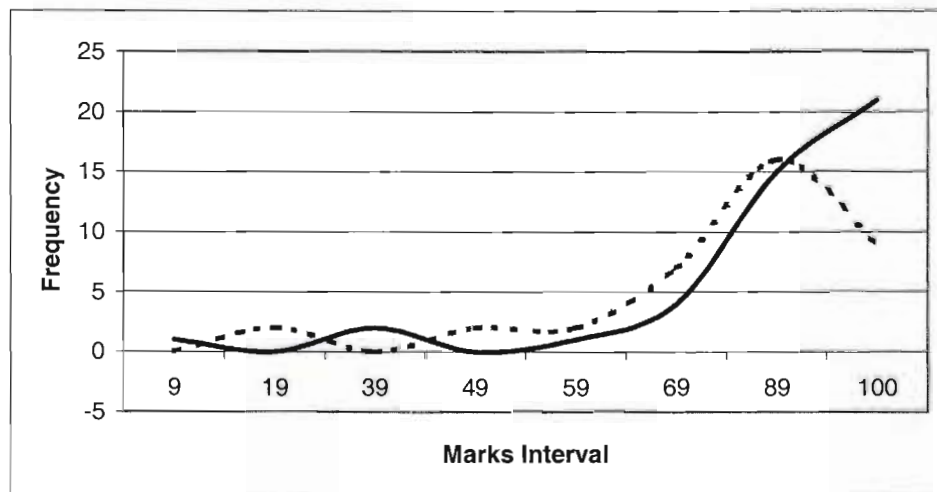
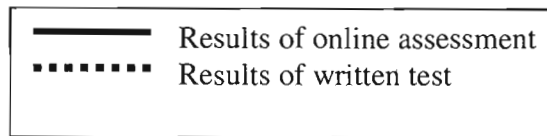


Figure 17: Line graph for results of the Operating Systems section

Written Assessment

Mean (px) = 76

Median (po) = 82

Standard Deviation = 19

Online Assessment

Mean (px) = 80

Median (po) = 87

Standard Deviation = 21

The results of the online and written assessments of the Operating Systems and Word sections of the programme indicate a negative skew, with approximately the same distribution for the two tests (Figure 17 and Figure 18). It can be said that students successfully achieved the specified outcomes of these modules.

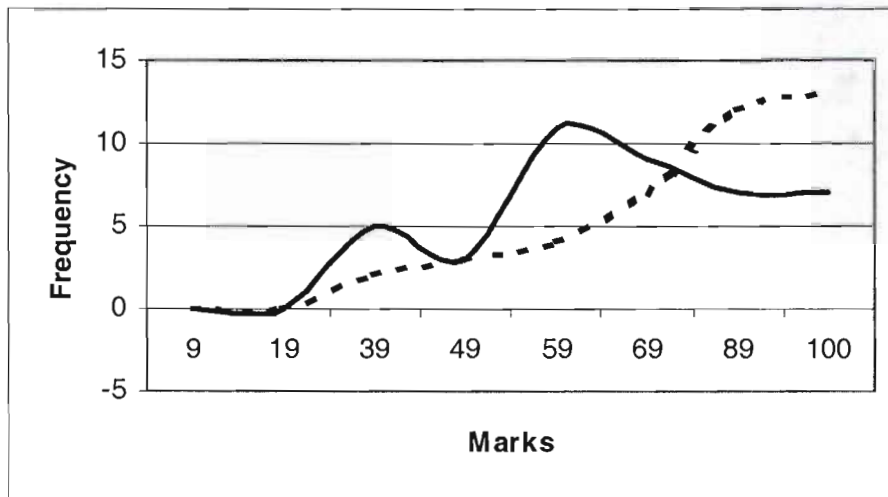


Figure 18: Line graph for results of the Word learning unit

Written Assessment

Mean (px) = 76

Median (po) = 80

Standard deviation = 18

Online Assessment

Mean (px) = 72

Median (po) = 71

Standard deviation = 25

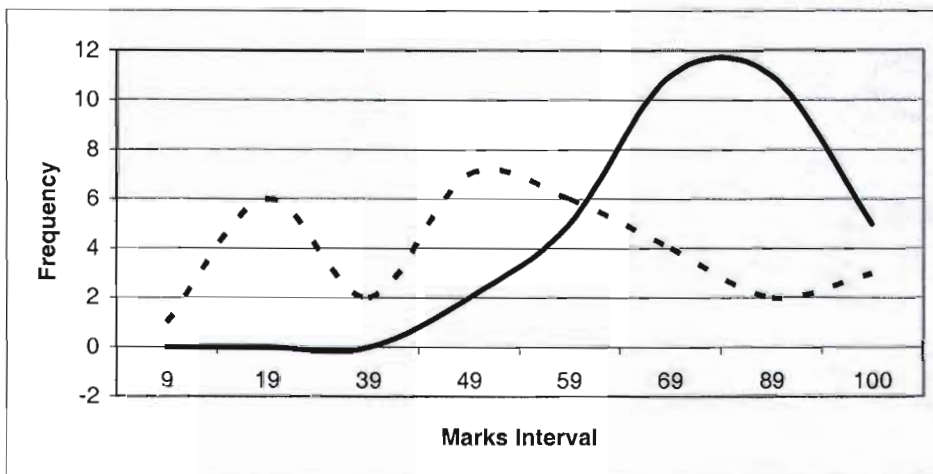


Figure 19: Line graph of results for the Excel learning unit

<u>Written Assessment</u>	<u>Online Assessment</u>
Mean (px) = 45	Mean (px) = 69
Median (po) = 40	Median (po) = 71
Standard deviation = 25	Standard Deviation = 18

In Figure 19 the results of the online assessment for Excel, clearly reflect a negative skew, this means that many students obtained very high scores and only a few students obtained low scores. High scores are an indication of the test being too easy, alternately that the majority of students have mastered the specified outcomes and are able to use Excel competently. In comparison the written Excel test reflects a positive skew, indicating that the students either did not master the outcomes of the learning unit or that the test was too difficult. The control group wrote the same written test, and scored well in the written assessment, therefore it is assumed that the test was not too difficult. Although the online test indicated that students mastered Excel, the written test shows no mastery of the material. A possible cause for this discrepancy is that the online assessment focuses on performing specific steps, while the written test is concerned with a practical application for Excel.

5.3 ANALYSIS OF THE RESULTS OBTAINED IN HS TRAINING

In Figure 20, the averages of the control group for the three sections of work, Operating Systems, Word Processing, and Spreadsheets (Excel), are compared to the averages of the experimental group for the traditional written assessments. For Operating Systems, Word Processing and Spreadsheets, the averages of the experimental group averages are substantially lower than that of the control group. From this data it clear that students did not understand the work properly, as opposed to those who received Instructor Led

Training. It can, at this stage, be stated that this online package did not address these three aspects of computer literacy adequately.

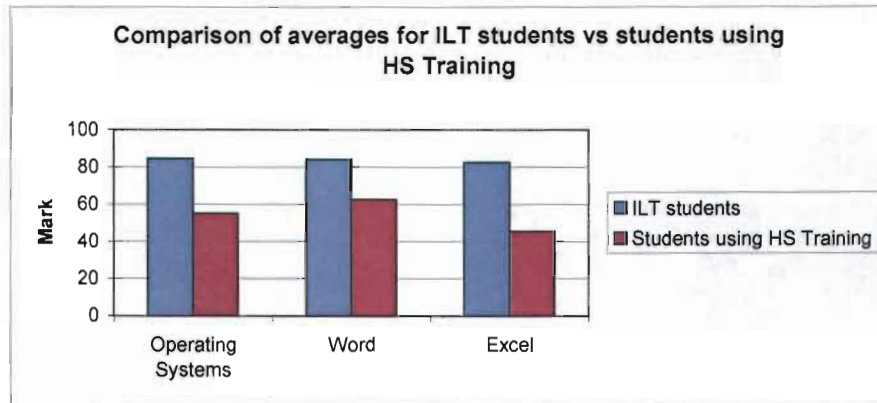


Figure 20: Comparison of averages for the experimental group and the control group for Operating Systems, Word Processing and Spreadsheets

In the following scatter plot graphs, the correlation coefficient (Easton & McColl 2005) is calculated to determine whether a correlation between the online assessment and the written assessment exists.

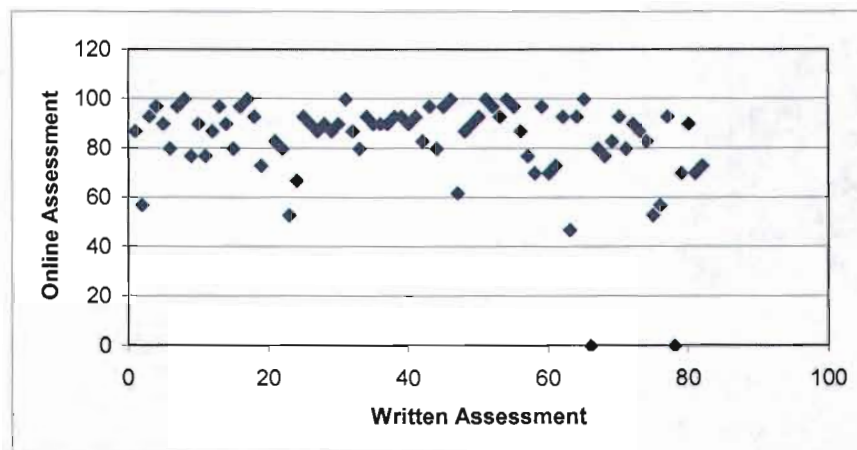


Figure 21: Scatter plot of correlation between online assessment and written assessment of Operating Systems

The correlation coefficient in Figure 21 is 0.016. There is no correlation whatsoever between the result of the online and written assessments for Operating Systems competence. Students appear to be competent users of an operating system when completing the online assessment on operating systems, but the written assessment shows the contrary. It cannot be said that students are competent in operating systems after completing the lessons in HS Training.

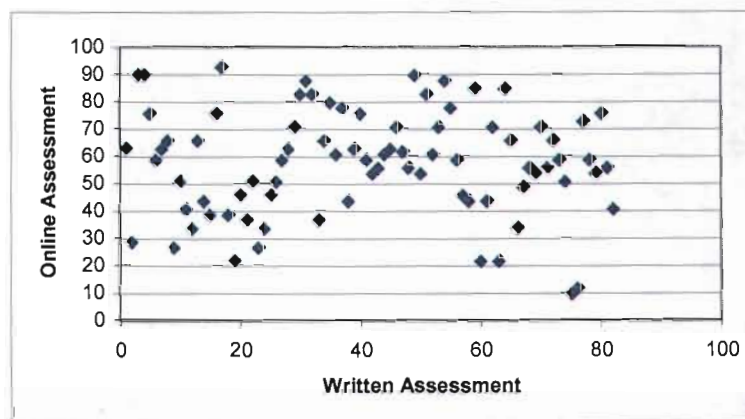


Figure 22: Scatter plot of correlation between the online assessment and the written assessment of Word Processing

The same procedure for Operating Systems competence (Figure 21) was followed for the Word assessment (Figure 22), the correlation coefficient for the population is calculated at 0.75. Here it may be said that, if a student performs well in the online assessment, it is an indication that he/she has mastered the Word Processing section of the programme.

The correlation coefficient for the Excel written and online assessment is 0.5 (Figure 23), with not many distinctive outliers. Students who performed well in the written assessment generally performed well in the online assessment as well, although students who did not do well in the written assessment, obtained from very low to very high marks for the online assessment. For competence in Excel, it cannot be said that a good

result for the online test indicates a mastery of the subject section, when results of the written assessment are taken into account.

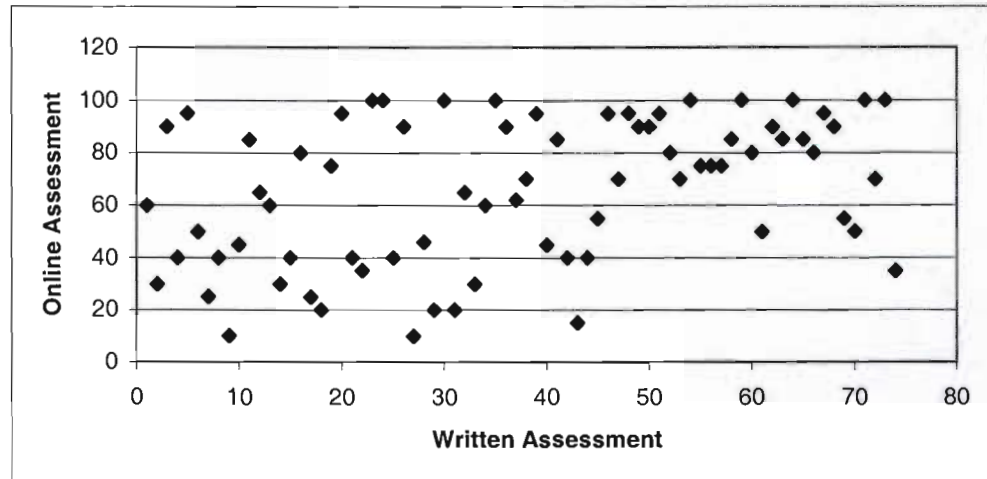
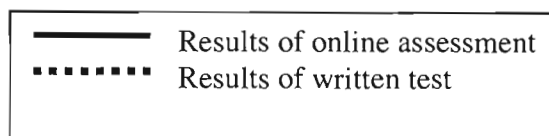


Figure 23: Scatter plot of correlation between the online assessment and the written assessment of Spreadsheets

The following three interval graphs are used to determine the validity of the tests. In theory, an interval graph captures the intersections among a set of intervals on the real line (Wikipedia 2006). The number of students with results that fell into each interval of marks, is calculated for the written and online assessments. These frequencies are then plotted on an interval graph. If the online assessment and the written assessment give the same distribution, the tests can be seen as valid.

The following legends will be used for the interval graphs:



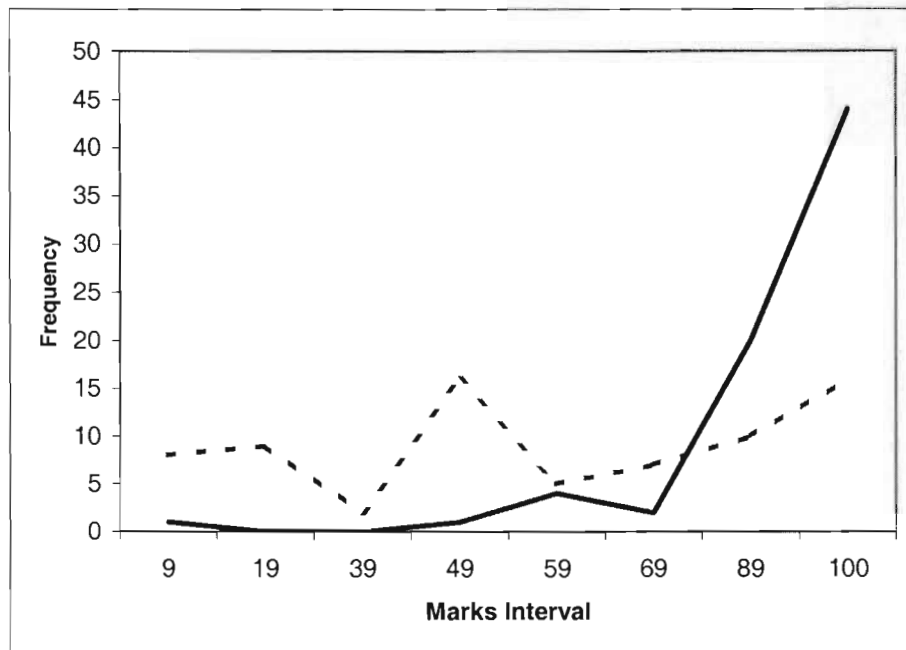


Figure 24: Line graph for results of Operating Systems

Written Assessment

Mean (μ_x) = 55.79

Median (po) = 59

Standard Deviation = 31.38

Online Assessment

Mean (μ_x) = 84.39

Median (po) = 90

Standard Deviation = 15.18

The results indicate that the online test was too easy because the majority of students performed very well in the online test. The mean is also substantially higher than that of the written test. Subsequently, although it may appear that students are competent users of an operating system after completion of the online test, the written test shows the contrary.

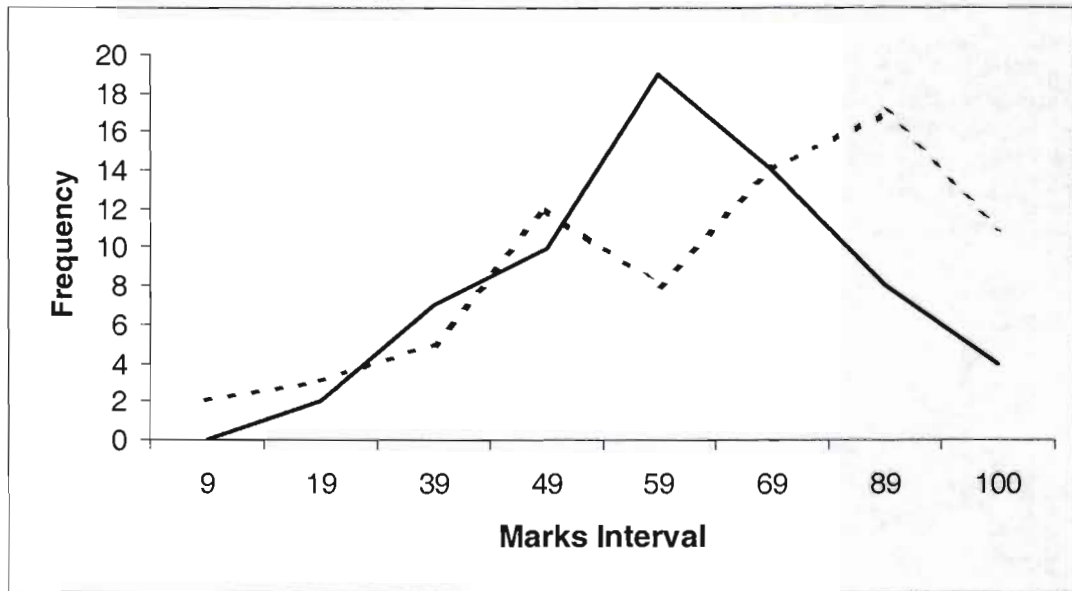


Figure 25: Line graph for results of Word

Written Assessment

Mean (px) = 62.36

Median (po) = 63

Standard Deviation = 24.16

Online Assessment

Mean (px) = 57.80

Median (po) = 59

Standard Deviation = 19.29

For the Word assessments, the distribution appear to be very similar (Figure 25). It can therefore be said that the two tests for Word Processing were valid. It may be assumed that students successfully achieved the specified outcomes of this section.

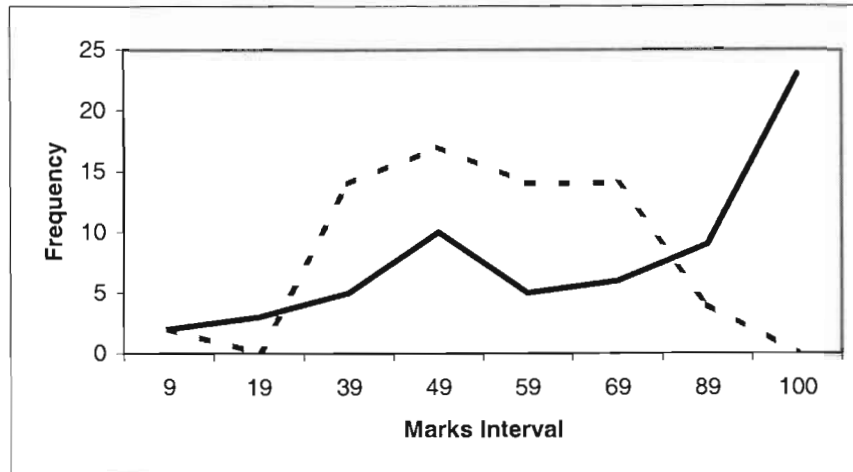


Figure 26: Line graph of results for the Excel learning unit

Written Assessment

Mean (px) = 45.56

Median (po) = 46

Standard Deviation = 17.52

Online Assessment

Mean (px) = 64.05

Median (po) = 70

Standard Deviation = 29.05

The results of the online assessment for Excel clearly reflect a negative skew (Figure 26), this means that many students obtained very high scores, and only a few students obtained low scores. This is an indication of either too easy a test, or that the majority of students have mastered the specified outcomes and are able to use Excel competently. When compared with the written Excel test that reflects a normal distribution, it can be an indication that the students either did not master the outcomes of the learning unit, or that the test was too difficult. The control group wrote the same written test, and scored well in it, it can thus be assumed that the test was not too difficult. Although the online test shows students mastered Excel, the written test shows no mastery of the material. A possible cause for this distribution could be that the online assessment focused more on performing specific steps, while the written test constituted written instructions for the student to execute on a practical application of Excel.

5.4 COMPARISON OF COMPETENCIES ACHIEVED BETWEEN STUDENTS COMPLETING LESSONS IN SIMNET, AND STUDENTS COMPLETING LESSONS IN HS TRAINING

The following graphs show the comparison of the mark distributions of written assessments done by the students in the experimental groups of both semesters. The graphs are shown in order to determine which of the two groups reached a higher competency level. It is the written assessments that are compared, because this measure of competency reached has been used for previous years in ILT. A student who passed this written assessment was seen as competent and passed the subject. This same measure will be used to assess whether students achieved a higher level of competency in SimNet or in HS Training.

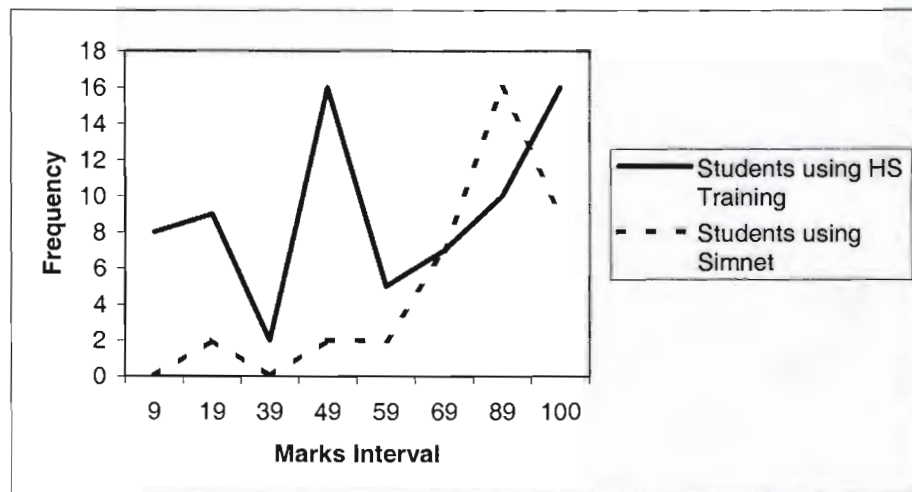


Figure 27: Comparison of results for the Operating Systems section

From Figure 27 it is clear that the number of students that obtain high marks in the Operating Systems unit using SimNet is higher than for HS Training. The number of students who used HS Training and scored below 50 percent, is substantially higher than those who completed lessons using SimNet. For Operating Systems it can be stated with

confidence that students who used SimNet reached a higher level of competency than the students using HS Training.

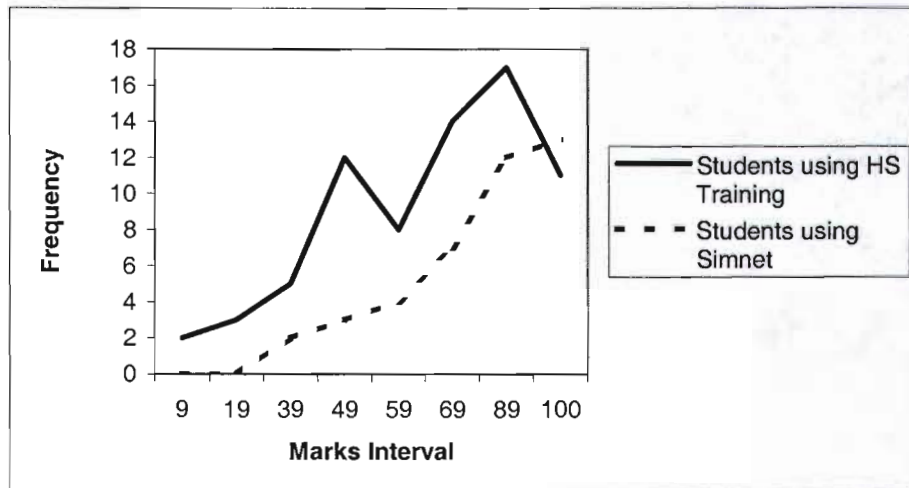


Figure 28: Comparison of results for the Word Processing section

The results in the line graph for Word Processing (Figure 28), for students using HS Training and the students using SimNet, follow more or less the same distribution. For the Word Processing, it cannot be said that the students using the one package achieved a higher level of competence than students using the other package. For the Word Processing part of the work, the two packages appear the same in delivering lessons. Students completed the lessons in both packages and achieved a similar level of competence.

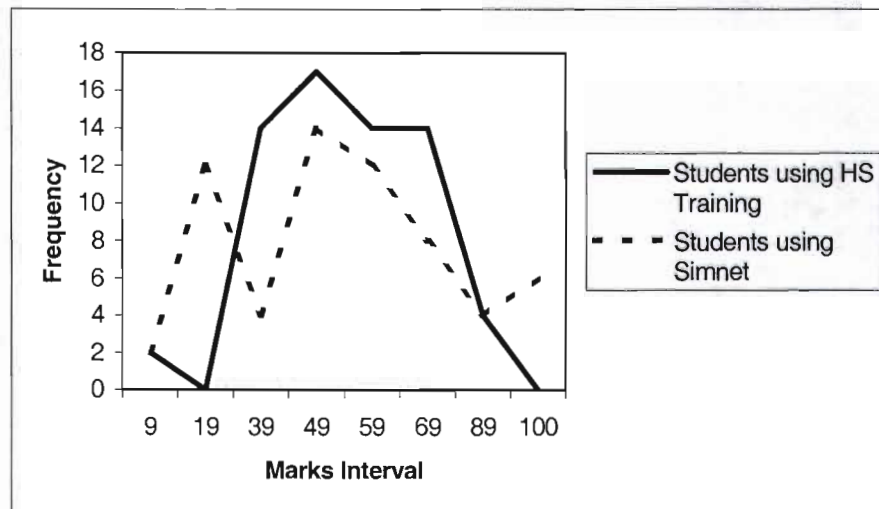


Figure 29: Comparison of results for Spreadsheets

The results obtained by the two groups of students for spreadsheets (Figure 29) closely follow the same trend. For Excel, it seems that the lessons addressed the content equally well.

5.5 CONCLUSION

In this chapter the statistical analysis of the quantitative data obtained from the assessments is presented. The averages of the control group for the three sections of the work, Operating Systems (OS), Word (W), and Excel (E), were compared to the averages of the written tests for the experimental group for students using SimNet. For Operating Systems and Word, the experimental group and the control group performed the same. It can be said that the online learning software package used by the students was adequate in explaining these two sections of the work, because the students who worked through the online lessons and the students who received Instructor Led Training performed the same. For Excel the experimental group achieved substantially lower marks than the control group. This is possible due to the use of formulas and functions in Excel being on a higher cognitive level and require more explanation than

for Operating Systems and Word. It may be said that the online learning did not address this aspect sufficiently. A blended learning approach should be considered for the Spreadsheet section of the work.

In Figure 23 the averages of the control group for the three sections of the work, Operating Systems, Word Processing, and Spreadsheets (Excel), were compared with the averages of the experimental group for traditional written assessments for students using HS Training. For Operating Systems, Word Processing and Spreadsheets, the averages of the experimental group were substantially lower than for the control group. From this data it is clear that students did not understand the work to the level of those who received Instructor Led Training. It can therefore be inferred that the HS Training package did not address these three aspects of computer literacy adequately.

Calculation of the students' year marks (the average of the three written summative assessments), 11.5 percent of the group who completed the lessons in SimNet were not successful in the course, while 25 percent of the group who used the HS Training software package were not successful in the course.

From this data it can be said that SimNet is the preferred package to use, because the competencies reached by the students who used SimNet were closer to the competencies of the control group; as opposed to the competence of students who used HS Training and were not sufficiently knowledgeable.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

The concluding chapter of this dissertation provides a summary of the research that was conducted in order to investigate online learning packages that may be used to offer computer skills training at VUT.

A set of criteria were developed to determine whether specified online learning packages offer quality computer literacy training. A locally developed and an international software package were compared. The results of the quantitative and qualitative investigations were collated and then analysed in order to determine whether VUT students can be successful users of online learning software.

This chapter further makes recommendations based on the research results and suggestions for further research are also provided.

In the introductory chapter, the purpose and aims of the study were explained. Attention was given to the background to the research and the importance of the research is stressed. The structure of the study is specified, the research problem is formulated (see 1.2) and the aims (see 1.3) and research methodology (see 1.4) are described.

In Chapter 2 a review of educational theory, including the different schools of learning was presented (see 2.4). The literature study provided the background information for the selection of online learning materials (see 2.4.1). The first section of chapter 2 focused on technology in learning in general and the second part of the chapter considered the implications of the different schools of learning on the selection of online

learning materials. Finally, guidelines for the selection of quality online learning materials, based on the discussed educational theories, were provided. These guidelines were based on a synthesis of the information gathered in this chapter, cognisance of the different schools of learning and the key elements of a good online learning approach (see 2.5).

In Chapter 3 the research design for this study was discussed. A combination of quantitative and qualitative data was used (see 3.3). The qualitative data was gathered through observations made while students were using the online learning software packages. The quantitative data was taken from the results students obtained for their assessments throughout the semester.

In Chapter 4, two online learning packages that offer computer literacy training were evaluated, to determine the quality of the packages and make a recommendation on the superior package. A variety of perspectives on the make-up of quality learning abound. Criteria for the measurements of the quality of learning were proposed in Chapter 2 (see 2.5.1) and applied to the selected software packages in this chapter in the form of a comparative evaluation.

In Chapter 5 the statistical analysis performed for the results obtained from students using the online learning material and students in the control group who received lectures from the instructor is presented. An overview of the results of each package is provided and descriptive statistics are shown (see 5.2 and 5.3). The results of users of the two packages are also compared (see 5.4) and discussed.

6.2 FINDINGS

6.2.1 Findings for Aim 1 – To develop a set of guidelines for the application of online learning for teaching computer literacy, where the majority of students come from a previously disadvantaged background.

With regard to the first aim the following deductions can be made:

- The number of virtual learning environments (VLE's), is increasing and online learning has been promoted as a solution for remote education. It is important to make an informed choice as to whether online learning should be used and which software should be purchased to provide the greatest advantage for VUT students (see 2.1).
- South African Higher Education Institutions face the challenge of overcoming the immense backlogs created by segregated education during the apartheid era. An understanding of the associated problems is critical in order to successfully implement online learning education programmes for previously disadvantaged students. The characteristics of quality higher learning and guidelines for the successful implementation of online learning have been investigated to ensure that the implementation at VUT will not encounter problems such as high dropout rates, low quality of learning and low satisfaction of students (see 2.1) that have been experienced in other cases of online learning.
- Although the benefits of online learning are highly lauded, the numerous implications of implementing an online learning programme effectively require careful consideration. A number of implementations of online learning programmes in Higher Education have been superficial in terms of learner participation. For many students online learning comprised the endless reading of

screen based text, that resulted in limited learner participation. The guidelines proposed in this dissertation are intended to ensure that VUT does not repeat the same mistakes (see 2.2).

- In order for Computer End Using at VUT to become an online learning course, it is important that the learning materials used are of good quality to guarantee student achievements. The goal of any instructional system is to promote learning; therefore, educators must understand the principles of learning and how students learn, before any learning materials are selected. This is especially relevant to online learning where the instructor and the learner are separated. The development of effective online learning materials should be based on sound learning theories (see 2.3) and an understanding of the context in which learning is to take place.

- There are three major approaches to learning that have been developed, namely behaviourism, cognitivism and constructivism. All of these schools of thought should be incorporated when effective online learning materials are designed (see 2.4). A synthesis of the benefits of these schools of thought should be incorporated.

- Application of the learning theories, five key elements emerge as important elements of an online learning process (Carman 2002:2). These key elements are used to evaluate software packages for online learning (see 2.5.1). They are:
 1. Live events – Live events refer to synchronous Instructor Led Training where all students participate at the same time. This may be in the form of a virtual classroom.
 2. Self-paced learning – The student completes learning experiences or tasks at an individual pace, for example, Internet-based or CD-Rom training.

3. Collaboration – Collaboration occurs in environments where students communicate electronically by means of e-mail or online chat.
4. Assessment – Assessment measures a student’s knowledge. Pre-assessments occur before self-paced events, to determine prior knowledge, and post-assessments occur after live or self-paced learning events to measure knowledge transfer.
5. Performance support materials – Reference materials that are intended to enhance learning retention and transfer. Examples include PDA downloads, printable references and summaries.

6.2.2 Findings for Aim 2 - To investigate two online learning products and characteristics for the online offering of computer literacy.

With regard to the second aim the following deductions can be made:

- The first criterion used to evaluate the two packages is *live events* (see 2.5.1). In this regard the two packages are equal. One package does not address *live events* more efficiently than the other, as *live events* are not built into either of the packages. The facilitator has to personally arrange these live events for the students.
- In terms of *self-paced learning* (see 2.5.2), it is evident that SimNet addresses a number of matters in a superior manner to that provided by HS Training. The layout of the SimNet package is clear, feedback is regular and frequent, and students can individually assess whether they are able to do the work on every page, this is not the case in HS Training.

- The third criterion used to evaluate the online learning packages, is *collaboration* (see 2.5.3). In this regard, no package can be singled out above the other, as students only have access to the study material in the computer centre, and not from home.
- *Assessment* (see 2.5.4) is the criterion that shows SimNet to be distinctly superior to HS Training. The assessment features of SimNet hold great advantages for online learning, and the shortcomings of HS Training are mostly related to poor assessment features. The assessment module in SimNet is interactive and builds on simulations. HS Training only has multiple choice questions, that are totally unsuitable to assess a practical skill such as using the computer.
- In terms of *performance support materials* (see 2.5.5), no package could be singled out, as neither packages provide support materials in addition to that which can be accessed electronically.

6.2.3 Findings for Aim 3 - To determine whether a difference can be discerned between the competence level of students who completed online computer literacy training, and that of students who completed the same course by means of instructor led training (ILT).

With regard to the third aim the following deductions can be made:

- For students using SimNet, the averages of the control group for the three sections of the work, Operating Systems (OS), Word (W), and Excel (E), were compared with the averages of the written tests for the experimental group. For Operating Systems and Word the experimental group and the control

group performed the same. It can be said that the online learning package used by the students provided sufficient explanation for these two sections of work, because students who worked through the online learning lessons and students who received Instructor Led Training performed the same. For Excel, the experimental group achieved substantially lower marks than the control group. One reason for this discrepancy could be that the use of formulas and functions are on a higher cognitive level in Excel and need more explanation than for Operating Systems and Word. It may be deduced that the online learning did not address this aspect sufficiently (see 5.2).

- For individual students in the experimental group using SimNet, the result obtained in the online assessment was compared to the result for the traditional paper-based test. For Operating Systems and Word, the tendency was that students who performed well in the traditional test, also performed well in the online test. The assumption is therefore made that, if a student performed well in the online assessment, it indicates the Operating Systems and Word sections of the programme have been mastered. For Spreadsheets, the distribution lies towards the lower marks area for the written assessment. This means that a student who performed well in the online assessment did not necessarily perform well in the paper test. In this instance it cannot be assumed that a good result for the online test indicates a mastery of the subject section (see 5.2).
- For students using HS Training the averages of the control group for the three sections of the work, Operating Systems, Word Processing, and Spreadsheets (Excel), were compared with the averages of the experimental group for the traditional written assessments. For Operating Systems, Word Processing and Spreadsheets the averages of the experimental group were substantially lower than those of the control group. From this data it is clear that the students did

not understand the work as well as those who received Instructor Led Training. It can therefore be said that this online learning package did not adequately address these three aspects of computer literacy (see 5.3).

- For individual students in the experimental group, using HS Training, the result obtained in the online assessment was compared with the result for the traditional paper-based test. For Operating Systems no correlation exists between the result of the written assessment and the result of the online assessment. Students may appear to be competent users of an operating system when completing the online assessment on Operating Systems, but the written assessment shows the contrary. It cannot be said that students are competent in Operating Systems after completing the lessons in HS Training. For Word Processing, the assumption is made that, if a student performed well in the online assessment, it indicates that the Word Processing section of the programme has been mastered. In Spreadsheets, the students who performed well in the written assessment generally performed well in the online assessment as well, although students who did not perform well in the written assessment, obtained from very low to very high marks for the online assessment. Subsequently the assumption cannot be made that a good result for the online test indicates a mastery of the subject section (see 5.3).
- The language issue was identified as a concern (see 2.1) at the outset of this research. Critics have said that students would not be able to complete online learning because everything is in English and no lecturer is present to explain terms, etc. Students did not appear to encounter problems with regard to language, because they could repeat a lesson as many times as needed in order to master the lesson.

- Overall, it appears that students who completed lessons in SimNet generally performed similarly to students who received Instructor Led Training. SimNet is viewed as the package that obtained the result most close to the results obtained by Instructor Led Training.

6.3 RECOMMENDATIONS

Recommendation 1

The subject Computer End Using can be effectively offered by means of online learning. The move to online learning can be used to solve two major problems faced by the Department of Computer Sciences (see 1.1):

1. Computer End Using students occupy computer laboratories that students of subjects such as programming could make far better use of.
2. Lecturers, spend hours on teaching Computer End Using, they could rather use their time and specialised knowledge to teach core subjects such as programming.

Motivation

According to the South African Qualifications Authority, computer literacy is on NQF level 4 (SAQA 2004). Although computer literacy is regarded as being a lower level than the first year of higher education, it remains an important prerequisite for the completion of qualifications. Subsequently it is imperative that higher education institutions offer training for fundamental computer skills. This is supported by the National Plan for Higher Education (NPHE), which emphasises the mainstreaming of academic development.

There is a high demand for computer laboratories at VUT and the Computer End Using department occupies a large number of these venues. The Management of VUT considers valuable resources (laboratories and the expertise of lecturers) to be wasted on a basic skill such as Computer literacy (see 1.1).

For students using SimNet, the averages of the experimental and control groups correlated well (see 5.2). Students using the online learning package performed similarly to students who received Instructor Led Training.

Recommendation 2

The online learning package that is recommended for the training of students to become computer literate is SimNet.

Motivation

Two online learning software packages were evaluated to determine the quality of the packages and to select the preferred package for VUT to use. Based on the five key elements outlined in Chapter 2, it was found that SimNet was the best package in terms of self-paced learning and assessment. The other three key elements (live events, performance support materials and collaboration) did not differentiate between the packages, both performed similarly in terms of these criteria. SimNet is therefore recommended as the preferred package for VUT students to use in order to acquire basic computer skills (see 4.5).

Recommendation 3

For students to perform well in the Spreadsheet section of the work (as for the other two sections), a blended learning approach is recommended for the spreadsheet section of the Computer End Using module.

Motivation

For Spreadsheets, the experimental group achieved substantially lower marks than the control group for students using both packages (SimNet and HS Training). This may be ascribed to the use of formulas and functions in Excel being on a higher cognitive level and require more explanation than that which is needed for Operating Systems and Word. It is possible that the online learning did not address this aspect sufficiently. In a blended learning approach a tutor or lecturer can explain the basic use of functions and formulas to students before they start working through the lessons individually. This will provide background knowledge and will ultimately result in better performances for this section of the work (see 5.2).

6.4 RECOMMENDATIONS FOR FURTHER RESEARCH

Recommendation 1

Students only had access to the learning material in the computer centre on campus. Ideally online learning should be able to take place wherever a student has access to a computer. A Computer Based Training package could be developed specifically for students of VUT to keep with them; so that they can use it at any location, at a reduced cost.

Recommendation 2

Further studies should be conducted to determine whether the poor performance for Spreadsheets can be resolved, without the need to involve a lecturer of that only that specific section. A possible solution is the use of blended learning with greater focus on problem- solving skills and mathematics.

6.5 CONCLUSION

The concluding chapter of this dissertation has provided a summary of the completed research project by means of an overview of each chapter. A number of findings from the literature have been presented, followed by recommendations and motivations.

In closing, the final deduction that can be made from the results of this study is summarised as follows:

Application of the knowledge gained through a review of pertinent literature and hands-on experience, a learning environment using online learning to teach Computer Skills can be implemented. The Operating Systems and Word Processing sections can be offered using an online learning approach, while the Spreadsheet section could be offered using a blended learning approach. Lecturers who previously presented Computer End Using can now be used for higher-level subjects, such as programming; additionally more laboratories will become available for the use of core subjects.

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