THE UTILISATION OF FORMATIVE AND SUMMATIVE ELECTRONIC ASSESSMENTS IN HISTORICALLY DISADVANTAGED INSTITUTIONS (HDI) IN THE WESTERN CAPE

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A thesis is submitted in partial fulfilment of the requirements for the degree of Masters in Information Management in the Department of Economic and Management Sciences, University of Western Cape.

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KEYWORDS

Educational Technology
Learning Management Systems (LMS)
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On-line Learning
Historically Disadvantaged Institutions (HDI)
Historically Advantaged Institutions (HAI)
Digital Divide
Electronic Assessment
Higher Education

ABSTRACT

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MIM thesis, Department of Economic and Management Sciences, University of Western Cape.

In this thesis, I explore the benefit of electronic formative assessment on learner achievement. Studies had revealed the connection between throughput and assessment. There is great discrepancy between the throughput rate of Historically Disadvantaged Institutions (HDI) and Historically Advantaged Institutions (HAI), according to the National Plan for Higher Education. Previously, assessment was used primarily for summative and certification purposes. Now, with the introduction of Outcomes Based Education (OBE), a number of alternative forms of assessment can be used. In this study I establish the importance and necessity of frequent, electronic, formative assessments which would thereby improve learners' achievement in the classroom.

The white paper on e-education (DOE: 2003) states that e-education must be transformed so that information and communication technology (ICT) can be successfully integrated to "ensure that all learners will be equipped for full participation in the knowledge society". Recent research has reported significant increases in learner achievement through educational technology with the use of learning management systems (LMS) software (Stephens, 2001, Buchanan, 2000, DeKock, 1994). This study was built upon this body of research on educational technology and how it can be effectively integrated into classrooms. This research would impact on learner achievement through the use of formative assessment to assist under-prepared learners to improve their summative scores. In particular, the effect of formative electronic assessment on learner achievement in the subject Business Information Systems, for first year accounting learners, in the Business Faculty at Peninsula Technikon was investigated.

This quantitative study utilized the use of questionnaires and the control group design. The control group design, which consisted of the control and experimental groups was used on a group of learners who had been exposed to the treatment. The treatment for the experimental group comprised of using a formative on-line learning assessment. Independent variables included the treatment condition, race, gender and home language.

Analysis of Variance (ANOVA) was used on assessment. Analysis firstly revealed that there was no statistically significant difference between achievement in the practical component between the experimental and the control group. The Kruskal-Wallis tests showed that there were no significant differences between genders. The control group performed better than the experimental group in the theory test. Secondly, analysis revealed statistically significant mean achievement differences between Coloured female with no prior computer usage (M= 78) and Black female with no computer usage (M=44).

Based on these findings, implications of the results of this study, future avenues of research and implementation suggestions are offered.

DECLARATION

I declare that the Utilisation of Formative and Summative Electronic Assessments in Historically Disadvantaged Institutions (HDI) in the Western Cape, is my own work, that it has not been submitted before for any degree or Examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Paliga Pillay

November 2005

Signed: ……..

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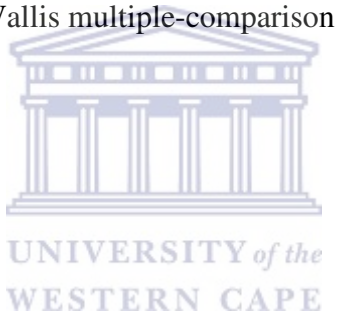


CHAPTER 1
THE PROBLEM AND ITS CONTEXT

1.1 INTRODUCTION AND THEORETICAL FRAMEWORK

At the foundation of every higher educational institution is the strategy to develop learners who are academically, socially and technologically competent. There is an intrinsic link between the strategy and the throughput rates of an institution. Many institutions allow these two domains to operate independently. In reality, strategy is at the heart of the throughput rate and is about choice. Historically Advantaged Institutions (HAI) had the choice about accepting learners mostly from an advantaged background, preventing access to many disadvantaged learners. In 1993 (DOE 1996a), 42% of qualifying learners from Historically Disadvantaged Institutions (HDI) earned undergraduate diplomas which signified that many did not meet the admission requirements for degree studies, while only 2% of qualifying learners from the HAI were in this category. The proportion of these disadvantaged learners in the higher education institutions is increasing, whereas throughput rates show no signs of improving (DOE 2004a). The DoE (1996a) has raised serious concerns over the graduation rates, which it says is costing the national government a great deal in terms of resources because of the poor academic performance of learners. Another area of concern is that the higher education system is not producing the numbers and types of graduates required by the labour market (Cloete 2001).

> … another major aspect of inefficiency in the system is the retention of failing learners in the system. A number of institutions report poor success rates by course (averages of 70% and below), low graduation rates (often 15% or below), and yet record no academic exclusions (Council on Higher Education [CHE] 2000).

The challenge is how to devise a system to address this declining quality at higher education institutions, as well as to assist under-prepared learners in order to improve academic performance and throughput rates. The purpose of this research was therefore to explore the integration of electronic formative assessment into a Business Information System classroom, and the impact it had on learner achievement.

At the start of this research, a model was developed based upon the author's educational experiences, observations and on the initial reading of the literature. This model (Figure 1.1 below) was used to research the benefits and pitfalls of electronic formative and summative assessment techniques in historically disadvantaged institutions.

THEORETICAL FRAMEWORK

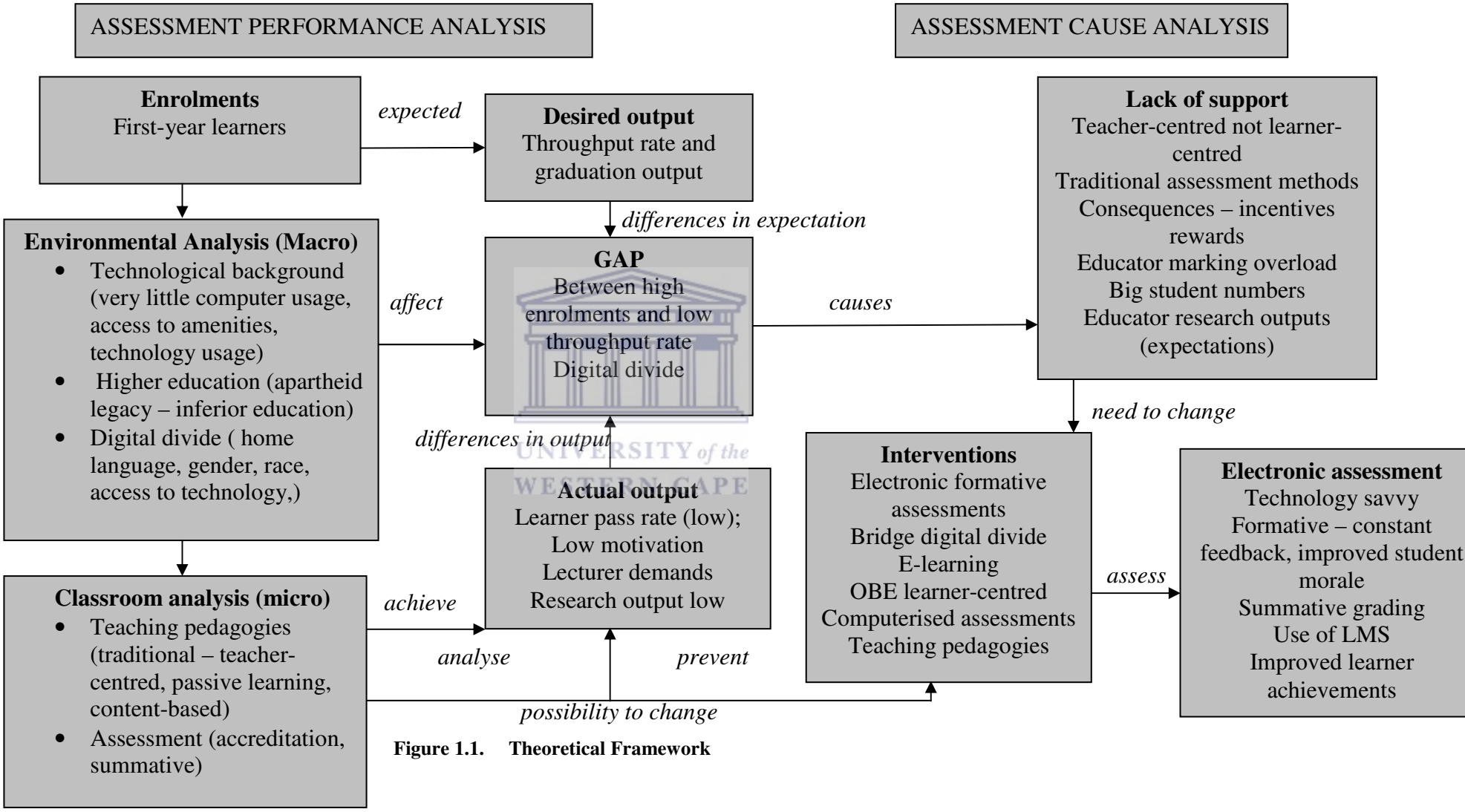


Figure 1.1. Theoretical Framework

Figure 1.1 above it shows how a gap can arise from the assessment performance analysis (left) and assessment cause analysis (right) between the outputs desired (according to the enrolments of an institution) and the actual throughput rate. The environmental analysis, which looks at the macro environment, stems from the learners' background and past practices in education. The classroom analysis, which looks at the micro environment, encompasses the learning programmes and all associations that affect the learner and educator in a traditional classroom setting.

Any discrepancy or gap between the desired and actual output that may have arisen shows that there is a need to change. The assessment cause analysis looks at the possible causes and interventions to narrow the gap. If that is the case, should interventions be put in place so that there is a change in classroom pedagogy? Should there be a move away from the traditional, behaviouristic pedagogy to a more learner-paced, constructivist pedagogy? Will this narrow the gap of the desired and actual output, and at the same time reduce educator mark loads and provide instant feedback to learners, thereby improving learner achievement resulting in improved throughput rate and graduate output? The challenge has been whether the utilisation of electronic formative assessment assisted to narrow the gap of the actual and desired outputs of the HDI.

1.2 DIGITAL DIVIDE

In examining the macro environment in Figure 1.1, the existence or non-existence of the digital divide had to be established. The existence or non-existence of the divide would have a bearing on the learners' use of educational technology. The digital divide has many definitions in different contexts. Warschauer (2003) defines *digital divide* as a bipolar division between the "haves" and the "have-nots", the "connected" and the "disconnected".

> … the digital divide can mean many different things to different sectors of our society. For some, the installation of a "tickey" box in the village takes residents into a new realm of communication. For others, a progression from a dial-up modem to broadband

> enables them to access information at a heightened level (World Summit on the Information Society [WSIS] 2005).

For the disadvantaged learner at Peninsula Technikon, the digital divide could mean the difference between a pass and fail. The digital divide describes the educational divide with the "resource-deprived" learners on one side of the spectrum, and on the other side the "resource-advantaged" learners (Herselman & Britton 2002). The South African education and training system has to respond to these pressures and challenges posed by the information revolution (DOE 2003). Studies have also revealed that the digital divide shows a further significant divide between gender, race and home language in the use of computer technology (Singh 2002; Slate, Manuel & Brinson 2002; McCoy & Heafner 2004). Institutions of higher education face the challenge of integrating technology into their teaching (Heydenrych, Higgs & Van Niekerk 2003).

> This challenge is made even more complex when seen in the context of other trends in education: the transition from passive classroom lectures to hands-on, learner-centred and the perception of learners as "customers" with increased control over the learning process (Radcliffe 2002).

1.3 TEACHING PEDAGOGIES

The inheritance of a didactic and behaviourist learning philosophy from the legacy of apartheid has been employed in our educational institutions. Figure 1.2 below displays the behavioural model of learning.

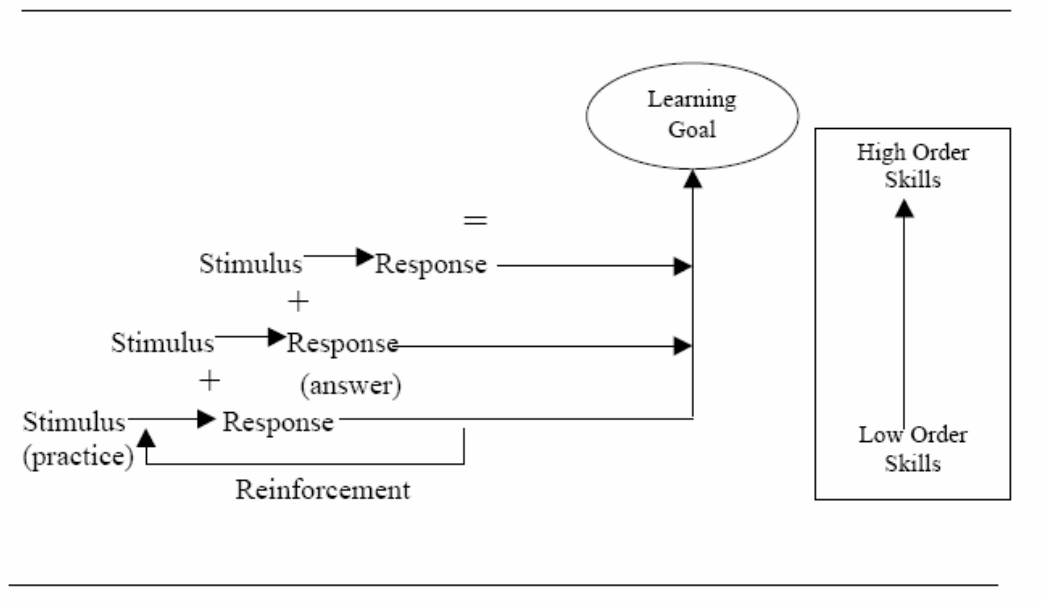


Figure 1.2. A behavioural model of learning

(Source: Smith, 2001)

Heydenrych et al. (2003) criticise this philosophy, Figure 1.2 above, where learners are seen as passive recipients "waiting to be led with expert content that is decided upon by specialists in isolation". With the onset of technology-oriented learning, there should be a shift in the pedagogy paradigm from teacher-centred and passive learning to the constructivist learning philosophy. Figure 1.3 below shows the constructivist model of learning.

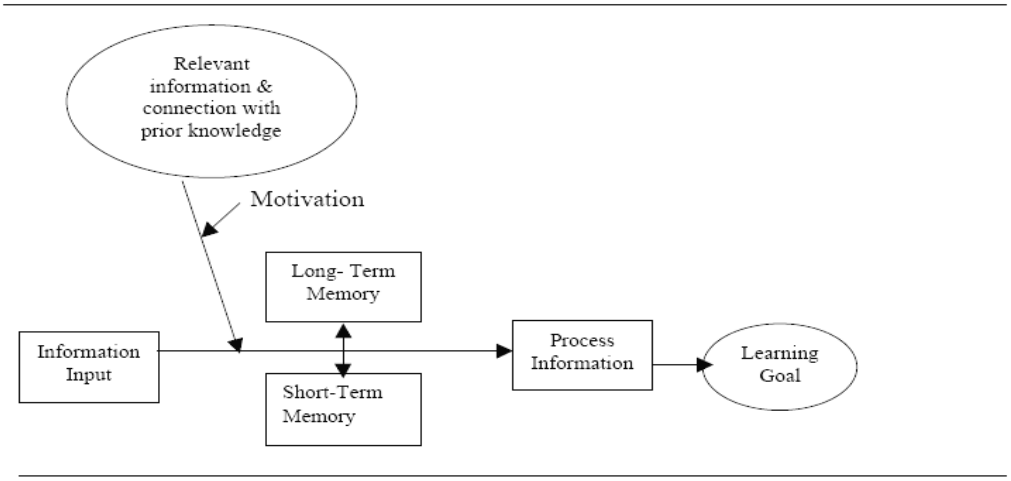


Figure 1.3. Constructivist model of learning

(Source: Smith 2001)

Heydenrych et al. (2003) explain that the constructivist learning experience, Figure 1.3 above, is one "in which the learner is building an internal representation of knowledge, a personal interpretation of experience", where the learner takes responsibility for his/her own learning. These authors further emphasise that institutions may engage "technologies for the sake of technology but when the pedagogical imperative is given priority, the quality of teaching and learning stands to be improved".

1.4 ASSESSMENT

Assessment in higher education institutions is a process of evaluating the learners' achievement of the learning outcomes while at the same time preparing learners for certification. Assessment involves identifying appropriate standards and criteria and making judgements about quality (Boud 2000). If the sole purpose of assessment is certification, the research examines the different models of assessment. The two distinct models of assessment that were investigated were summative and formative.

1.4.1 Summative assessment

Summative assessment is normally given at the end of a unit of work, which serves the function of certification, which can be used for graduation purposes. This gives a quantitative grading and judgement about a learner's achievement in a specific area (McKenna & Hesketh 2000). Knight's (2002) conception of assessment was that of a "feedout" function when it was used for certification or achievement as opposed to the feedback function when it was intended to evoke information to help further learning. The "feedout" and "feedback" functions of assessment have become confused in practice and, consequently, formative assessment in higher education has failed in becoming a part of valued learning (Harlen, Wynne, James, Mary 1997).

There has been strong criticism against the use of results in learners studying only as a means to an end rather than participating in a deeper learning and knowledge acquisition process (Black & William 1998a). Experience of teaching over the last few years has revealed that the results (diagnostic analysis) of an assessment need to be a learning curve for both lecturer and learner and not a report that needs to be completed as part of an institutional requirement. Recent research shows there needs to be a paradigm shift in assessment, in order to narrow the gap between the actual and desired levels of throughput at HDIs, from the current assessment paradigm (summative functions of assessment) to a learning, problem-solving paradigm (formative function of assessment) (Harlen, et al. 1997; Biggs, 1998; Boud 2000; Black & William 1998a).

1.4.2 Formative assessment

Summative assessment serves the purpose of accreditation, promotion or graduation. Formative assessment serves a function of feedback to the learner in the learning process, which promotes further learning and improves results in summative assessments. According to Black and William (1998a), all successful teaching relies heavily on adapting the teaching in the light of evidence about the success of previous episodes. Harlen, et al. (1997) indicate the following characteristics of formative assessment, namely that it is essentially positive in intent, it is directed towards promoting learning and it is therefore part of teaching. Black and William (1998b) used approximately 580 articles in 160 journals in their study, which confirms that there is a body of firm evidence that formative assessment is an essential component of classroom work and that its development can raise standards of achievement. This study also indicated that formative assessment helps low achievers more than other learners.

Boud (2000) argues that formative assessment has been neglected, as summative assessment has dominated thinking in educational institutions and has taken up too high a proportion of staff time, energy and resources at the expense of preparing effective learners. This has led to serious implications in higher education courses that are always moving on to tackle new areas of learning

without ascertaining whether those that have gone before have been adequately understood (Boud 2000).

The White Paper on Higher Education Transformation (DOE 1997) states that higher education should be restructured so as to meet the "… needs of an increasingly technologically oriented economy". Recent research has reported significant increases in learner achievement through educational technology with the use of Computer Aided Instruction (CAI) software (Stephens, Bull & Wade 1998). With the rapid increase in learner numbers, practical constraints may make it difficult for lecturers to provide feedback that is both timely and useful to the learner (Buchanan 2000). For this reason, the implementation of computerised formative assessment may be the solution.

1.4.3 Computerisation of assessment

Formative assessment can be beneficial to learner and lecturer, if the time lapse between assessment and feedback is short. Computerised formative assessment provides the following benefits: automatic test analysis statistics to be produced with immediate compilation of learner marks (Stephens 2001); a reduction in time spent by lecturers on administration (Stephens 2001); freedom of any gender or cultural prejudices (Stephens 2001); and swift and useful feedback to learner and lecturer (Buchanan 2000). Learners can revisit the questions or an assessment as many times as necessary until the learner understands the concept. With immediate feedback of results and answers, learners can monitor their own progress and guide the lecturer on the success of the lecture. Problems experienced by learners can therefore be re-addressed in class. These results could lead to an improvement in learner pass rates and thereby improve the graduate output. How many of our academics give learners feedback and suggestions on their assessments? Experiences of teaching at an HDI have shown that academics often complain about the poor quality of learners. Access to electronic formative assessment could provide the means to improve the throughput rates and could further bridge the digital divide for our disadvantaged learners.

1.5 STATEMENT OF THE PROBLEM

With the strong movement of the Department of Education (DOE 2003) to integrate technology into the curriculum, a single question remains unanswered. Does technology, specifically computers, for formative assessment improve learner achievement?

1.6 RESEARCH OBJECTIVES

This research focused on developing a better understanding of the effects of electronic formative assessment in a constructivist, technology-rich learning environment. In particular, this research attempted to –

1. provide insights into the digital divide, the technological and language background of first-year learners;
2. examine the efficacy of online learning; and
3. determine empirically the effect of constructivist, technology-rich learning environment, specifically the use of electronic formative assessments, on learner achievement.

Such information should provide valuable guidance to educators or designers seeking to determine how computers can best be used to maximise educational benefits or what the long-term impact of computers will be on educational productivity.

1.7 LIMITATIONS AND DELIMITATIONS OF THE STUDY

The subjects of the study will be limited to Business Information System 1 learners in the Accounting Diploma from the Faculty of Business at Peninsula Technikon.

1.8 ORGANISATION OF THE STUDY

This report is divided into five chapters. Chapter 1, *Introduction and theoretical framework*, includes a description of the problem and its context, the statement of the problem to be studied, the research objectives of the study, and limitations and delimitations of the study.

Chapter 2, *Literature review*, consists of a literature review of studies relative to the use of computer technology in the classroom and variables associated with the effective implementation of electronic formative assessment into the curriculum. This chapter begins with a review of the digital divide with regard to gender, race and language; concerns of the government on the gap between the enrolment and low graduate success at higher education institutions; and the use of computerised assessments and its benefits and pitfalls to learners and educators.

Chapter 3, *Research methodology*, discusses the research design and the methodology utilised in this study. A description of the population, instruments, hypothesis, ethical considerations and method of analysis used is included.

Chapter 4, *Results*, presents the results of the study. Descriptive statistics and results of the quantitative analyses are discussed within the context of each of the hypotheses and further expanded upon in Chapter 5.

Chapter 5, *Discussion and conclusion*, is the final chapter of the study. It includes a summary of the study and a discussion of the conclusions based on the results of the study.

CHAPTER 2
LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this study was to explore the effect of electronic formative assessments on learner achievement in historically disadvantaged institutions. This literature review explored related studies in the macro and micro environment of the use of electronic formative assessment by –

1. assessing the digital divide with regard to gender, race and language;
2. discussing the concern of the government on the gap between the enrolment and low graduate success at higher education institutions, and
3. using computerised assessments.

2.2 DIGITAL DIVIDE

Digital divide can be defined as "the wide division between those who have access to information and communication technology (ICT), and are using it effectively, and those who do not" (Bridge.org 2001). Information and communications technologies (ICTs) are becoming the foundation of our societies and economies, and the digital divide implies that the information "have-nots" do not have the opportunity to participate in the new economy (Bridge.org 2003). There is also a digital divide between HDIs and HAIs, gender, race/ethnicity and age with regard to ICTs. How does higher education help to narrow this divide, and how does it assist the disadvantaged learners to access ICT? One method of measuring the digital divide is in terms of ownership of basic amenities, including a computer, the Internet, and the new telephony, the

cell phone. Figure 2.1 below show the percentages of ownership of the basic amenities according to the 1996 census.

2.2.1 Basic amenities

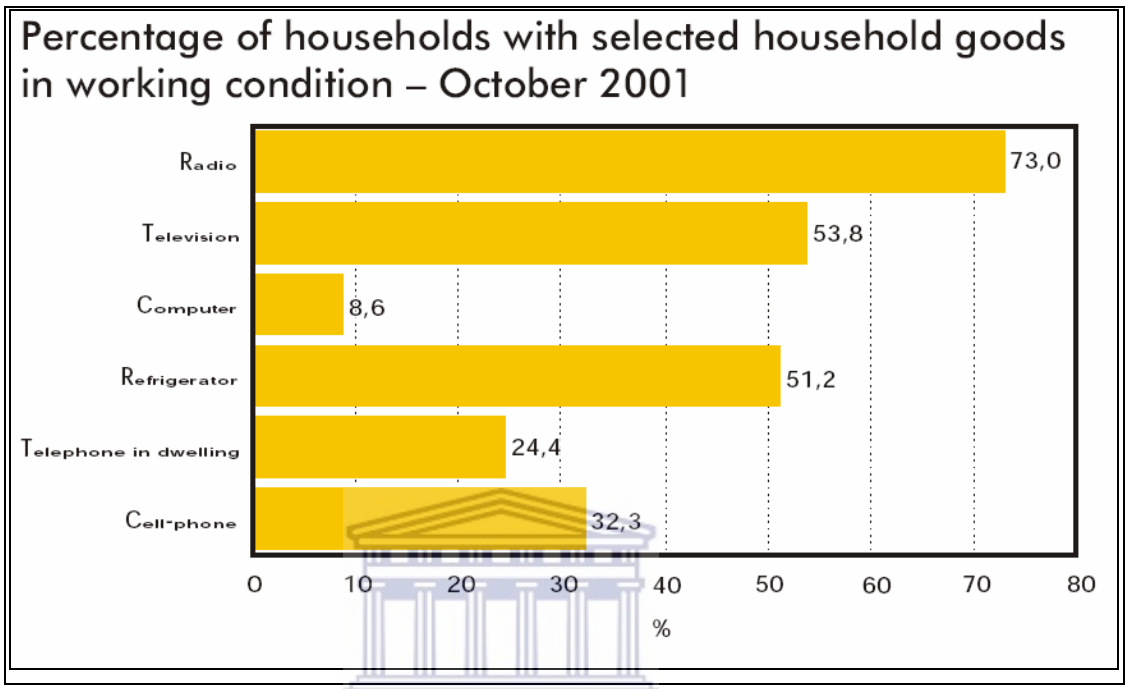


Figure 2.1. Household goods Oct 2001
(SOURCE: StatsSA 2001)

Figure 2.1 above shows evidence of the digital divide in household access to basic amenities (StatsSA 2001):

> … graph masks differences between population groups. For example, the much-spoken-of 'digital divide' is evident in the fact that less than 2% of African-headed households had a computer, as opposed to 46% of white-headed households. Similarly, only 12% of African-headed households had a telephone in the home, as against the national total of 24%, shown in the graph. This may in part explain the popularity of cell phones: twice as many African-headed households had cell phones (25%) as had fixed-line telephones.

According to StatsSA (2001), nearly three-quarters of households in the country had a radio, well over half had television, and just over half had a refrigerator. At the other end of the scale, fewer than 10% had a computer. As can be seen in the

following extracts, lower-income communities in South Africa have very little or no access to a computer:

- Herselman and Britton (2002) conducted a case study research on 80 Grade 12 learners from various institutions from resource deprived or ”have-not” communities in the Port Elizabeth area. Only 11.5% of all learners tested had regular access to a PC, whilst 21.25% had only used it a few times, and 60% had never used a computer before under any circumstances.
- Callaghan and Smit (1999) did their research at the Technikon Pretoria, by means of questionnaires. The research targeted learners who did not have previous experience of using computers. None of the respondents had English as their home language. Research indicated that respondents were afraid of and unsure about using the computer for the first time. After six months of usage, learners showed confidence and had high expectations of what they could do with the computer.
- The research by Misthry, Mkhize and Harypursat (2001) was aimed at determining the technological and language background of the respondents at the University of Durban Westville, as well as the possible relation between this background and their knowledge of computers prior to entering university. The research showed that the majority of respondents came from public schools and many of these learners had never used a computer before coming to the university.
- Singh’s (2002) research shows that in the year 2000, 33 postgraduate learners at the University of Durban Westville were taught Information Management, and none of them had used a computer previously. In 2001, there were 40 learners and in 2002, 45 learners who had never used a computer before.

2.2.1.1 South Africa

South Africa has approximately 4.92 million installed telephones and 4.3 million installed exchange lines. This represents 39% of the total lines installed in Africa (Telecommunications 30 August 2004). There are about 12 million Internet users on the continent, of whom 3.1 million are in South Africa (Telecommunications 30 August 2004). In Africa, one in every 200 persons has Internet access, compared to one in 30 globally, and one in three in advanced economies (Cronin: 2003). The high access prices to the internet are seen as a significant barrier even among people with access to computers (Bridges.org 2003). According to Webchek (2002), Internet usage amongst South African Web users is relatively equal between genders, while the majority of men are advanced users of ICT. Thirty-one percent of all users are between the ages of 18-24, 63% are English-speaking, 69% white, 25% have an monthly household income of R30 000+ and 55% have some university or tertiary qualification (Bridges.org 2003).

Recent studies have shown a rapid expansion of cell phone and Internet usage in South Africa (Bridges.org, 2003; Telecommunications, 2004). There are more cell phones than landlines in South Africa. In May 2004, South Africa had 18.2 million cell phone users (Telecommunications 30 August 2004). However, the acquisition of some of these rapidly evolving technologies is beyond the reach of the lower income communities in South Africa. Under the legacy of apartheid, these lower income communities were provided with inferior education and poor or no access to learning opportunities (Singh 2002).

South Africa is the fourth largest GSM (Global Systems for Mobile Communications) market in the world and is developing at a rate of 50% per annum (Bridges.org 2003). This market is dominated by Vodacom (which has 10 million users) and MTN (which claims 5.22 million) and in 2001 a third licence was awarded to Cell C, which had about three million subscribers in May 2004 (Telecommunications 30 August 2004). Cheap cell phones and prepaid phone cards have made communication accessible to millions of disadvantaged South Africans, although cell phones are used primarily for receiving calls (Bridges.org:2003).

2.2.1.2 Western Cape

In January 2002, the Cape Town City Council embarked on an assessment of the digital divide in Cape Town, in terms of ICT and its possible benefits. The demographic profile from Table 2.1 below compares favourably with the Cape Town City Council assessment of the digital divide that shows "a large portion of the Western Cape population is highly literate and financially stable, but the majority of people are below the bread line, do not have a fixed or mobile telephone, access to a computer, e-mail, or the Internet" (Bridges.org 2003). Table 2.1 below shows evidence of the disparity in the annual personal income per race group.

Table 2.1. Demographic profile of Cape Town residents

(Source: Bridges.org 2003)

Table 16: Cape Metropolitan Council 2001 – Demographic profile of Cape Town residents

	Black	Coloured	White	Asian
Total Population	702,000	1,313,000	631,000	36,000
Unemployment by Gender				
Female	50%	22%	6%	9%
Male	33%	18%	5%	17%
Average Annual Personal Income	R4,200	R15,000	R48,000	R24,000

Source: CMC 2001; data from 1996

In the Western Cape, 82.4% of schools have computers and 56.1% have one for teaching and learning, whereas nationally the percentages are 39.2% and 26.5% respectively (DOE 2003). Thirty-two percent of the Internet users in the Western Cape are between the ages of 18-24, 76% speak English, 58% are male, 61% are white and 33% are coloured, 23% have a monthly household income of over R30 000 and 59% have a university or tertiary qualification (Bridges.org 2003).

Webchek (2000) also found higher use among historically less marginalised groups ("white" and "coloured" respondents) (Bridges.org 2003).

2.2.2 Race

Within countries, there is a significant division regarding the use of technology along the line of race. In the United States, many early reports on the digital divide has been done extensively on race, and it has been revealed that Asian Americans and Pacific Islanders have the highest level of home Internet access at 56.8%, whereas blacks and Hispanics experience the lowest home Internet access at 23.5% and 23.6% respectively (Bridges.org :2003).

In South Africa, the racial classification system drawn up by the apartheid regime was divided among African, white, coloured (of mixed race) and Indian (of Asian decent) people (Bridges.org 2003). Mangena (2001) commented that the insidious and difficult spin-off from the apartheid education legacy was the "… fact that competency in science-related fields was also employed to perpetuate theories of difference among the races".
Table 2.2 below describes computer and Internet access by young people up to the age of 35 according to race in South Africa (Saner 2003).

Table 2.2. Access to/can use computer/Internet

(Source: Saner 2003)

	Computer		Internet	
Race	**Access**	**Can use**	**Access**	**Can use**
Black	19%	16%	8%	5%
Coloured	34%	39%	16%	16%
Indian	53%	73%	27%	38%
White	88%	91%	65%	70%

TOTAL	**28%**	**27%**	**15%**	**13%**

Studies indicate the significance of race on learner achievement (Singh 2002, Roodt 2003). The integration of computer-assisted learning into the existing curriculum of heterogeneous classes, should improve learners' academic achievement and their motivation (Roodt 2003).

2.2.3 Gender

In the past decade, there has been substantial growth in the higher education sector. This growth has been reflected for both male and female learners. However, the DOE (2003) shows that the increase in enrolments at higher education institutions of African females, at 33%, constitutes the largest share of head count learner enrolments in 2003. The overall enrolment by race group was 60% African, 6% coloured, 7% Indian and 27% white. Female learners had a 54% share of the total enrolment.

Table 2.3. Increases in enrolments

(Source :DOE 2003)

INCREASES IN ENROLMENTS (2003 compared to 2000) (thousands)		
African female	46	24%
African male	37	24%
Coloured female	8	53%
Coloured male	4	30%
Indian female	7	37%
Indian male	5	27%
White female	17	21%

White male	7	9%
Female total	**77**	**25%**
Male total	**54**	**19%**
OVERALL TOTAL	**131**	**22%**

With the increasing demands on the higher education system, cognisance should be taken of the glaring disparities regarding the use of technology between males and females learners in the higher education system. Gender differences across curricula areas have been studied:

> … sexual hierarchy, as evidenced within both the education and labour sector, is not the dictate of biology but is the result of socially constructed norms. These norms have played a direct role in the creation of a gendered digital divide that is primarily caused by a lack of women pursuing careers in science and technology. A variety of sociocultural reasons for the sex related differences are offered (McClean 2001).

McClean (2001) elaborates by indicating that studies revealed that there are very few powerful, active female role models in computer games or software and software programs reinforce gender bias and stereotypical gender roles.

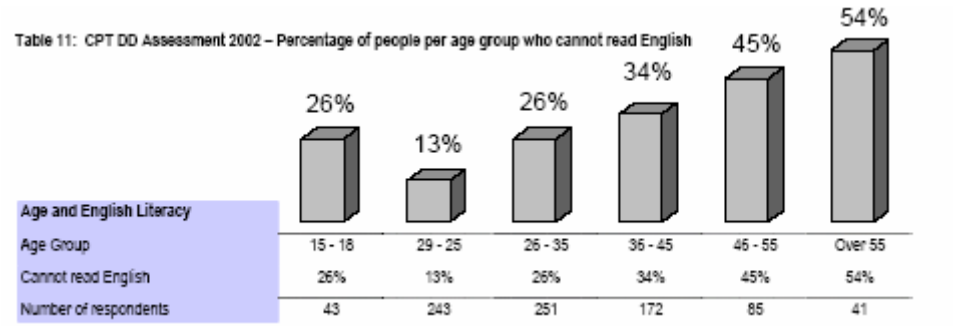
When using computers, females have been considered as having a higher level of computer anxiety than males and they are regarded to experience more negative feelings toward computers than male users (Brosnan 1994, as cited in Stephens 2001). Stephen (2001) elaborates that this is usually the case because males have spend more time with computers at home, work and/or school while females are discouraged to use computers at school. McCoy and Heafner (2004) conducted a survey on 389 female and 408 male learners at an american university. By the end of their 4th year, these learners had lived and worked in a computer-intensive environment for their entire university careers. The survey evaluated attitudes towards computers and the uses for computers. The results of this study showed that males were heavier uses in entertainment, but as a tool and for communication, there were no differences between males and females. Males and females that make use of email and application programmes, for example Microsoft office, showed no differences in their use of computers. Stephens

(2001) also found that no differences were evident between female and male learners that had been using computer-assisted assessments, at higher education institutions.

2.2.4 Language

South Africa has 11 official languages. In the Western Cape, the three official languages are English, Afrikaans and IsiXhosa. The majority of the learners at HDI in the Western Cape have English as their second or third language. Most of the technology and software programs that are used in higher education institutions are in English. English is recognised as the language of commerce and science. In 2001, however, it was spoken at home by only 8.2% of South Africans, an even lower percentage than in 1996 (8.6%) (StatsSA 2001). English is also the most common language on the Internet across the world. The following table shows the results of a survey conducted by Bridges.org (2003) in Cape Town on those who cannot read English.

Table 2.4. People per age group who cannot read English
(Source: Bridges.org 2003)



These people may be marginalised, as ICT becomes part of society (Bridges.org:2003).

The education departments' e-education (DOE:2003) document infers that the "digital divide is not only about connectivity and infrastructure disparities" but it

is also about local language content (DOE 2003,2). What does this mean for people who are not literate in the language that dominates the Internet?

The above literature on the digital divide has shown examples of students' non-accessibility to technology. Literature has also shown how home language, gender and race have further widened the gap between the "haves" and the "have-nots". The National Plan for Higher Education (DOE: 1996b) makes provision for better funding and provision of better access to information technology for HDIs. Can these institutions be in a better position to make a positive contribution? Can these higher education institutions play a vital role in bridging the digital divide, by turning to technology to solve the teaching, learning and assessment problems brought about by the apartheid era?

2.3 HIGHER EDUCATION

According to the Green Paper on Transformation (DOE:1996a)

> Under apartheid, education was divided along racial/ethnic lines, excluding blacks from quality academic education and technical training. The Extension of University Education Act of 1959 applied this ideology to higher education. New universities were created, for African, coloured and Indian students, who were permitted entry to white universities only to pursue programmes not offered at black universities. Technikons, created from 1978 onwards, were also developed within the apartheid framework.

In 2000, the South African higher education landscape consisted of 36 higher education institutions, which consisted of 21 universities and 15 technikons. The difference between the universities' role and the technikon is that the former provides general formative and professional education, basic and applied research, and the latter a vocational and career education and "product-related" research and development (DOE 1996b). The technikons have less autonomy than universities, are subjected to external budget control, and programme approval procedures (DOE 1996b).

The National Plan for Higher Education (DOE: 1996b) proposed the "establishment of comprehensive institutions through the merger of universities and technikons". The new higher education landscape after the merger comprises 11 universities, and the previous technikons now constitute 6 universities of technology in the new institutional landscape, similar to institutions found in Australia, Germany and Belgium.

The post-1994 government inherited from the apartheid legacy a higher education system that was

> … segregated by race; unequal in terms of gender and language; divided by the distinct functions performed between universities and technikon; and set apart by highly uneven quality between and within different historical institutions (CHE 2003).

One of the grave concerns facing the government is the gap between the pass rate expected by institutions and the actual performance of the learners (Business Day 2003). South Africa's higher-education institutions spend $163 million a year of the money they receive from the government on the 25% learners who do not complete their studies (Rossouw 2001). "Between 2000 and 2003, learner enrolments grew at unexpectedly high rates. The rate of enrolment growth exceeded the provision of the government subsidy allocations to the higher education system" (DOE: 2004a). . According to Higher Education Management Information System (HEMIS), the proportion of disadvantaged learners in the higher education institutions is increasing, whereas learner output rates shows no signs of improving (DOE:2004a).

One of the key issues as regards learner enrolment planning for higher education is the emphasis of the throughput and graduation rates (DOE 2004a). Table 2.5 shows that about 36 000 (or 30%) of the total cohort of 120 000 first-time entering undergraduates dropped out at the end of their first year of studies.

Table 2.5. First-time entering undergraduates

(Source: DOE 2004a)

PROGRESS OF 2000 COHORT OF FIRST-TIME ENTERING UNDERGRADUATES			
	Universities	**Technikons**	**TOTAL**
Dropped out at end of 2000	25%	34%	30%
Dropped out at end of 2001	9%	13%	11%
Dropped out at end of 2002	7%	11%	9%
Total dropped out 2000-2002	**41%**	**58%**	**50%**
Graduated in 2002-2003	**26%**	**19%**	**22%**
Studying in 2003 but not completing	**33%**	**22%**	**28%**
TOTAL IN COHORT	**59 000**	**61 000**	**120 000**

Table 2.6 shows the annual average success rates, which were calculated as ratios of degree credits to FTE enrolments for the system for the period 2000-2003 (DOE 2004a).

Table 2.6. Annual success rates 2000-2003

(Source: DOE 2004a)

WEIGHTED AVERAGE ANNUAL SUCCESS RATES 2000-2003				
	2000	**2001**	**2002**	**2003**
Universities	66%	66%	71%	68%
Technikons	62%	63%	66%	66%
AVERAGE FOR THE SYSTEM	**65%**	**65%**	**69%**	**67%**

Although there seems to be an improvement in the pass rates between 2000 and 2003, there is a strong indication that one third of the learners have either failed or dropped out of the tertiary institution (DOE 2004a).

The Higher Education Quality Committee (HEQC) frameworks and policies place emphasis on teaching and learning practice, i.e. the curriculum should be in line with national policy targets with respect to throughput and graduate output (DOE 2004b). Emphasis was also placed on the teaching and learning approach to "promote access and success for learners from disadvantaged educational backgrounds" and curricula should be designed in such a way that learners from "poor learning backgrounds" could attain their potential (DOE 2004b).

On the one hand, it could be said that appropriate quality mechanisms will have to be put in place to reduce repeater, drop-out and failure rates of students so that institutions can discharge their education and training missions and responsibilities. On the other hand, it could be argued that the scars or the legacy of apartheid inherited by HDIs could take a number of years to be overcome.

2.4 ASSESSMENT

Lin and Gronlund (2000) define *assessment* as "a general term that encompasses the full range of instruments used to gain information about learning (observations, ratings of performances or projects, paper-and-pencil tests)". Maree and Fraser (2004) further define *assessment* as "the organized purpose of the level to which outcomes are reached by learners". Siebörger (1998) states, "… the focal purpose of assessment is to gain information and give feedback about the progress of learners". The Department of Education declares that

assessment is an important driver in education, which, if not well managed, can become a barrier to innovation (DOE 2003).

According to the National Plan for Higher Education, the Higher Education Quality Committee (HEQC) has now become responsible for the appropriateness of the curriculum and the way standards are set and assessed. Previously, higher educational institutions could survive only if they managed their enrolments effectively and if there was no regard for how and what kind of learning took place (Rucker & Schoenrock 2000). There was no accountability regarding "whether or how learners were changed as the result of the educational experience" (Rucker & Schoenrock 2000). There needs to be reconciliation between assessment for learning and assessment for accountability (Hayward & Hedge: 2005). Now, with the enrolment caps on government funding, there is a stronger emphasis on learning and teaching, the throughput rate and graduation output. It is imperative to "match enrolment plans with available resources to enable the higher education system to deliver on its teaching and research mandate" (DOE 2004). Since the first democratic election in 1994, "… the system of higher education must be reshaped to serve a new social order, to meet pressing national needs, and to respond to a context of new realities and opportunities" (DOE 1996b). One of the main areas in which educational reforms have taken place has been the adoption of the Outcomes-based Education (OBE). This curriculum design had to be implemented from January 2001 in higher education institutions.

Before the introduction of OBE, the assessment system was mainly norm-referenced and primarily summative. According to Maree and Fraser (2004), norm-referenced assessment refers to the comparison of learners' achievements with those of other learners or with pass marks or benchmarks to determine how well the learner is doing. These authors argue that this approach is more content-based than learner-centred and does not seem to focus on what the learners have mastered or understood. In the outcomes-based approach,

> … the formulated outcomes will guide how the teaching-learning process must be constructed so that learners can be empowered with the knowledge, competencies and

> values to fulfil the real-life roles when exiting the education system, as well as guiding learning process by means of appropriate assessment (Maree & Fraser:2004).

The OBE assessment is criterion-referenced and formative in that it informs and shapes learning (Newfield, Andrew, Stein & Maungedzo 2003). Maree and Fraser (2004) discuss criterion-referenced assessment as "consisting of certain criteria that learners are expected to achieve in a particular grade". They elaborate that the criteria are related to learners' competencies in particular areas, skills acquired, and attitudes expressed. Learners need to be made aware of the outcomes at the outset or as early on in the programme as possible; the assessment process should be clearly laid out.

2.4.1 Outcomes-based education

Siebörger (1998) defines *outcomes-based education* as "an approach to teaching and learning which stresses the need to be clear about what learners are expected to achieve". The educator and learner are aware beforehand what performance is expected of learners. Siebörger (1998) declares this to be an outcome. According to Maree and Fraser (2004), outcomes have two common features. It could be –

> … a verb that describes the action (collect, analyse, measure, etc.) and a noun or phrase that describes how/where/on what the action will be performed …

The educator and the learner need to have a clear understanding of the outcomes, so that the educator can assist the learner in achieving these outcomes. Assessment is the measure of the degree to which the learner has achieved the outcomes. Learning outcomes are grouped into three domains by curriculum designers and educators: the *cognitive* domain (mental processes); *psychomotor* domain (body movements and physical action) and *affective* domain (attitudes, values and emotions) (Maree & Fraser 2004). The taxonomy of educational objectives is used in identifying learning outcomes that should be considered in the cognitive domain, when developing objectives for classroom instruction (Lin & Gronlund 2000). Assessments

need to test the different levels of the cognitive domain. This is based on progress from the simple to the complex. Maree and Fraser (2004) refer to Bloom's taxonomy of cognitive outcomes, namely

- *knowledge:* involves memorisation and recall of information;
- *comprehension:* involves making meaning of things, rather than just remembering them, and is the lowest level of understanding;
- *application:* the ability to use abstract information and ideas in concrete situations, such as solving problems;
- *analysis:* the ability to examine information systematically to identify the hierarchy of ideas;
- *synthesis :*the ability to construct something new, to make a coherent whole; and
- *evaluation* –the ability to make judgement about the quality of things.

The reconfigured higher education system should expand on technology-based capabilities (CHE 2000). The White Paper on Higher Education Transformation (DOE 1997) states that higher education should be restructured so as to meet the "... needs of an increasingly technologically-oriented economy". How can technology be employed with OBE to bring the disadvantaged institutions on par with the advantaged?

2.4.2 Computerised assessments

The draft white paper on e-education (DOE 2003) defines *e-learning* as "flexible learning using ICT resources, tools and applications, focusing on interaction among teachers, learners, and the online environment". E-learning uses learning management systems (LMS), such as WebCT, Blackboard and Kewl as a web-based platform for facilitating e-learning. WebCT is being used by 3000 institutions worldwide, in South Africa by 80 institutions. Some of the related terms to e-learning include computer-based training (CBT), computer-related technology (CRT), computer-assisted instruction (CAI), computer-assisted education (CAE), computer-assisted assessment (CAA) and online education. The meanings of these terms are starting to merge. The Education Department (DOE 2003) believes that developments in ICTs can

> …create access to learning opportunities, redress inequalities, improve the quality of learning and teaching, and deliver lifelong learning. ICTs can accommodate differences in learning styles and remove barriers to learning by providing expanded opportunities and individualised learning experiences.

Literature seems to indicate that there could be a possibility to use electronic assessments across different subjects or disciplines, but the outcome and the benefits might be different. De Kock and De Kock (1994) used a mathematics computer-aided learning (CAL) programme for disadvantaged learners entering a tertiary institution as a special academic support programme, and it was established that computerised testing can be an efficient way to overcome the educational crisis in South Africa, provided that learners are motivated and enthusiastic. Factors that have a positive influence of electronic formative assessments (Aster 2003):

- can be used as a diagnostic test, e.g. to inform the lecturer of the level of knowledge of the learners on a particular topic;
- as a remedial exercise – to bring learners up to the required level to understand what will be discussed in class;
- during a class, as a form of problem-based learning; and

- after a class, to check on learning and reinforce concepts.

Peat and Franklin (2002) describe how Bloom's taxonomy can be used as a guide to develop different levels of increasing cognitive development in electronic formative assessment:

> *Level 1: Test content and knowledge*, by using multiple-choice questions and drag and drop scenarios, with the answer always on the screen.
>
> *Level 2: Test application of content*, using some multiple choice questions, but mostly with a format that expects text input from the learner.
>
> *Level 3: Test analysis*, using question formats as for Level 2, but with the addition of two-part questions and formats requiring the building up of diagrams, flowcharts, etc.
>
> *Level 4: Test synthesis of information*, the most used format being free-flow prose, where the learner is expected to synthesise information in response to a question. This format is not computer-marked but assessed by the learners comparing their work with sample answers, and with the option of self-scoring their own performance.

Studies that have been conducted internationally and nationally have revealed that electronic formative assessment and learner-based learning have a positive effect on learner outcomes as compared with the traditional, instruction-based, teacher-centred learning, provided that other interventions to promote technology assisted learning, are in place (Aster 2003; McCabe and Skinner 2003; Roodt & Conradie 2003; Ricketts & Wilks 2002; Khan 2001; Buchanan 2000; McKenna & Hesketh 2000; Bull & Stephens 1999; O'Reilly & Patterson 1999; Stephens et al 1998).

2.4.3 Meta-analysis

According to Gorard (2001), meta-analysis is a "method that can take all past studies, allot them their appropriate influence without undue bias, and so compile

a clear and convincing account of the current state of knowledge in the field". In meta-analysis, the results from an individual study are assigned an effect size (ES) which is a value assigned to it according to its size, quality and the effectiveness of the treatment condition (Gorard, 2001). McCabe and Skinner (2003) conducted a meta-analysis on 20 peer-reviewed studies from 1997 to 2002. These studies comprised groups of learners of not less than one hundred in each sample. McCabe and Skinner (2003) reported that on their combined samples of 4314 learners, they discovered that electronic formative assessment teaching has a small but positive effect on learner outcomes when compared with traditional instruction. In this study, the effect size (ES = '0') showed no difference between the experimental and control group, but there was a difference between the scores obtained between the experimental and control group. The report showed that the experimental group, which was exposed to technological instruction, received higher scores in their summative assessment.

2.4.4 Summative assessment

The majority of studies available for review seem to be on the use of computerised assessments for formative purposes. Stephens et al. (1998) point out that, as materials become refined following formative use, they are often incorporated into summative assessments. These authors expand on this by indicating that summative assessment is used to provide a more varied assessment and is used with more traditional and other innovative practices when compared to formative and computerised assessments. Bull and Stephens (1999) explain that the use of computerised summative assessment involves a greater need for staff development and time to ensure that effective assessment takes place. The summative environment needs to be formal, structured and invigilated (Stephens et al. 1998). In the case of distance learning, summative techniques can be very successful when utilising internet technologies, and it can be flexible, self-paced and self-directing when supported by virtual groups of online learners and experts (O'Reilly 1999).

2.4.5 Formative assessment

Successes reported by recent studies with the use of computerised formative assessments for learners and staff include the following:

Learners

- immediate, individualised, convenient and meaningful feedback to learners, which is anonymous and non-threatening. Learners can monitor their educational progress, which can direct them to further study(Khan 2001);
- learners have a closer match between the assessment and learning environment (Ricketts & Wilks:2002);
- learners can remedy whatever weaknesses the assessment has exposed, after feedback; tests can be used repeatedly in order to assess extent of improvement (Buchanan: 2000);
- learners can follow up references and resources, through feedback (Stephens et al. 1998).
- feedback enables grades to be "relayed and justified", as well as providing an opportunity to help learners to improve their understanding (Brown et al. 1997, cited in Bull & Stephens 1999);
- can be experimental, learner-centred and learner-led, fast, consistent and effective feedback (Stephens et al. 1998); and
- assist learners in closing the gap between actual and desired levels of performance(Black & William 1996)

Staff

- allows for greater levels of independence where learners are self-directed while enabling staff to attend to those learners requiring greater assistance (O' Reilly & Patterson 1999);

- where large number of "learners or lengthy pieces of work are involved, practical constraints (such as time or workload pressure)" allow for fast and useful feedback to learners (Buchanan 2000);
- staff can monitor learner activity and progress (Bull & Stephens 1999);
- diagnose learners' problems and follow their progress more easily; also be alerted to issues learners are having difficulty with these in class and re-address it (O'Reilly & Patterson 1999); and
- reduction of time spent marking, preparing necessary administrative information, accurate marking across a range of answers, freedom of any gender or cultural prejudices, improved turn-around time for results to learners and producing reports (Stephens et al. 1998).

Literature demonstrates that electronic formative assessment process could be used to motivate students to learn. In addition, the introduction of formative assessment would need some radical shift in classroom pedagogy. There is strong evidence to support that the use of computers in a learning environment can be conducive to learning for both educator and learner.

2.5 AGAINST TECHNOLOGY

Recent research has indicated barriers to successful integration of computer-assisted assessments in higher education: institutional policies, teaching pedagogies, and teachers' philosophy to teaching and learning, and learners' perceptions (Ricketts & Patterson 2002; Scase & Scott 2001; Stephens et al. 1998).

2.5.1 Institutional policies

Scase and Scott (2001) encountered the following problems while implementing computerised assessments in psychology at their higher education institution:

- infrastructure problems – the networking of hardware and software and not being able to use certain software on the network;
- creating an awareness and dissemination of information to academic staff;
- commitment of staff time to training;
- support from the institution's information system;
- the need for policy and strategic planning within subject areas, in specific schools and faculties and across the higher education institution; and
- the need for a central proactive team that can provide encouragement and support.

Stephens et al. (1998) include the following as well:

- an institutional information strategy required to underpin the application of technology to the curriculum in an economical and effective way in order to achieve volume results (Campbell et al. 1996, cited in Stephens et al. 1998); and
- institutional support and security.

Kestner, Hall & Limback (1999) asserts that there is not a high level of commitment from the faculty involved or support from higher levels of the university.

2.5.2 Teaching pedagogies

Aster (2003) indicates that the most common type of computerised assessment are multiple choice questions or questions requiring precise or short answers, which are more commonly used in the sciences. Stephens (2001) argues that multiple choice tests lack depth in testing subject knowledge and maintains that this type of questions encourages learners to guess. Bonk (2002) states that there is a need for software that provides for online debates, role playing, comparison and contrast, or brainstorming (other than chat tools).

2.5.3 Educators' philosophy to teaching and learning

Beffa-Negrini, Cohen and Miller (2002) argue that academics feel that face-to-face environments, verbal repetition and feedback to learners can clarify written directions, whereas enthusiasm and empathy are lost in online learning. Academics also feel that they are losing control of one of their major teaching activities by no longer directly grading their learners' papers (Stephens et al. 1998). Bonk (2002) asserts that the academics need training to teach effectively on the web. Selwyn (1997) contends that the main disadvantage for educators using computerised assessments is the increased time involved in administering the tests.

2.5.4 Learners

Learners may be disadvantaged with the learner-assessment interface and the scrolling of question papers, which mimic the paper-based test (Ricketts&Wilks:

2002). Learners indicated that online testing may or may not match their learning styles, especially if they are kinaesthetic or hands-on learners (Rucker & Schoenrock 2000). Rucker and Schoenrock further suggest that English as second language (ESL) learners and other diverse learners find the reading of questions from a computer monitor difficult and time-consuming and timed tests may therefore not be advantageous to these learners.

2.6 CONCLUSION

Based upon the literature review and the needs indicated previously, this study attempted to explore the effect of electronic formative assessments on learner achievement in historically disadvantaged institutions.

Literature has shown that there are two perspectives in examining the impact of educational technology in higher education. The first perspective is a micro approach (as shown in Figure 2.5) that focuses on classroom assessment, teaching pedagogy, educational technology, educators and learners. The second is a macro approach that examines the influence the environment has on the learner relating to the apartheid legacy, the digital divide and institutional and government policies.

In the micro approach, literature reveals that with the introduction of outcomes-based education, there are many advantages and disadvantages to the alternative forms of assessments that could influence the learning outcomes. There has been great emphasis on frequent, formative assessments, which has led to an improvement in summative scores. With the shift to OBE, the teaching pedagogy changes from behaviouristic to constructivist. There is also strong evidence to support technology-based learning, which has been of great benefit to both educators and learners. Literature has also shown that there is resistance amongst educators to adopt the new teaching pedagogy. This has led to frustration for the educator and learner with the use of the "old" traditional mode of teaching in the

new outcomes-based curriculum, which has been further aggravated by the introduction of educational technology.

In the macro approach, literature has shown that the apartheid legacy has left its scars on education. This has given birth to the digital divide in South Africa, which is also a world phenomenon between the "haves" and the "have-nots" in the global information society. There are many government policies in place to redress the inequalities of the past, by focusing on the previously HDIs of higher education, so that they can produce graduates with the knowledge, competencies and skills to contribute to the economic and social development of the country. There is strong evidence from literature that shows that technology-based learning has failed in many institutions because institutional policies were not in place to support technology-based learning. There is also a stronger indication in literature that with training and support from the institution, technology-based learning has a very positive impact on throughput and graduation rates. The introduction of technology-based learning in South Africa would involve a completely new teaching and learning paradigm for the learners and educators.

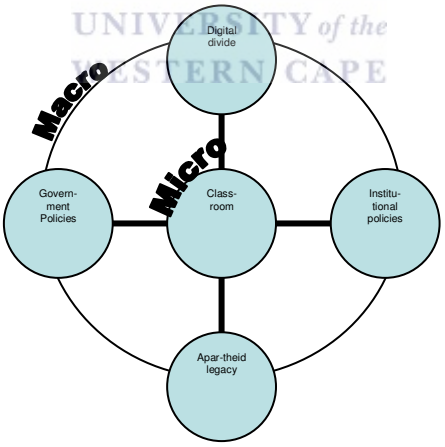


Figure 2.2. Micro and macro perspectives

CHAPTER 3
METHODOLOGY

3.1 INTRODUCTION

The aim of this research is to determine how the utilisation of electronic formative and summative assessments in higher education can improve learner achievement. This chapter presents a discussion of the research design and methodology used to explore the aim of this study. Firstly, a justification for the design chosen and a description of the research setting is provided. Secondly, a description of the population, instruments, and data collection procedures, including ethical measures, validity, reliability, hypothesis, and method of analysis used is included.

3.2 RESEARCH DESIGN AND METHODOLOGY

A research design is a plan or blueprint of an investigation to obtain answers to research questions or problems (Babbie & Mouton 2001). The design focuses on the end product, the study that is being planned and the kind of results that are expected. The research methodology focuses on the research process and the kind of tools and procedures to be used. According to Zikmund (2003), the terms *qualitative* and *quantitative* are used frequently to identify different modes of inquiry or approaches to the research process. *Quantitative research* is all about quantifying relationships between variables, about individuals' perceptions and insights into relationships about the world (Bell 1987). *Qualitative research* is based on recognition of the importance of the subjective, experiential "life world" of human beings. Burns (2000) describes qualitative research as being naturalistic, involving the importance of subjective experience of individuals, an ideographic approach and as a holistic analysis, as opposed to the criteria of reliability and statistical compartmentalisation of quantitative research. Table 3.1 below

shows some differences between qualitative and quantitative methodologies (Babbie & Mouton 2001).

Table 3.1. Qualitative and quantitative methodologies

Orientation	Quantitative	Qualitative
Assumptions of the world	A single reality can be measured by an instrument.	Multiple realities, e.g. interviews with educators, learners, parents.
Research purpose	Determine the quantity or extent of some phenomenon in the form of numbers	Provides greater understanding of a concept or crystallises a problem.
Research methods and process	Deductive generalising	Inductive contextualising
Notion of objectivity	Maximum control over extraneous factors	Gaining trust and rapport in order to get as close as possible to subject
Researcher role	Detached with use of instrument	Prepared person becomes immersed in social situation

Quantitative research uses the deductive process (as shown in Figure 3.1), which starts with an abstract, logical relationship among concepts and then move toward concrete empirical evidence, as opposed to the inductive process used in qualitative research (Neuman 2000). The inductive process (as shown in Figure 3.1) starts with only vague concepts, which are then refined, to develop empirical generalisations and identify preliminary relationships (Neuman 2000). The following figure shows deductive and inductive theorising (Neuman 2000).

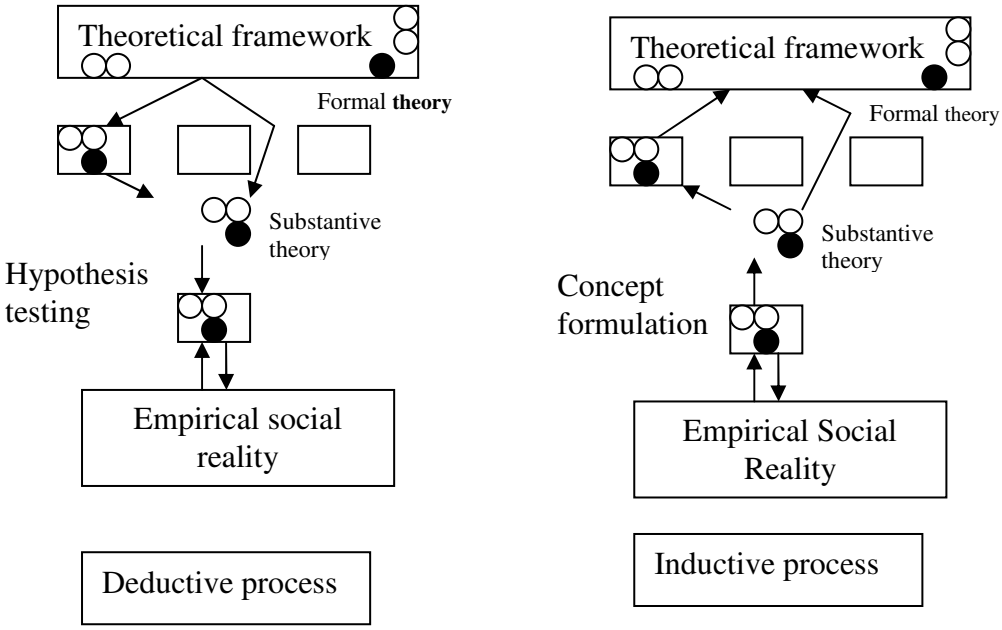


Figure 3.1. Deductive and inductive theorising

(Source: Neuman 2000)

3.2.1 Qualitative research

The main features of qualitative research, according to Neuman (2000) are:

1. capturing and discovering meaning once the researcher becomes immersed in the data;
2. concepts are in the form of themes, motifs, generalisations, and taxonomies;
3. measures are created in an ad hoc manner and are often specific to the individual setting or researcher;
4. data are in the form of words and images from documents, observations, and transcripts;
5. theory can be causal or non-causal and is often inductive;
6. research procedures are particular, and replication is very rare; and

7. analysis proceeds by extracting themes or generalisations from evidence and organising data to present a coherent, consistent picture.

Research is based on assumptions. The most significant assumption that underpins qualitative research is based on the underlying epistemology, which guides the research. According to Myers (1997), "epistemology refers to assumptions about knowledge and how it can be obtained". The three categories based on the underlying epistemology are shown in the figure below (Myers 1997).

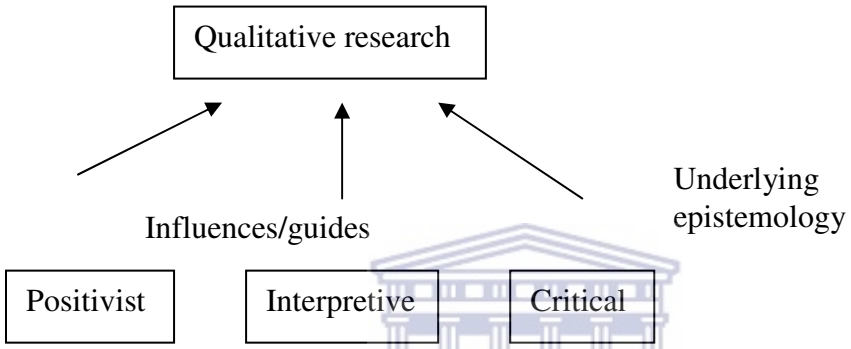


Figure 3.2. Underlying assumptions
(Source: Myers 1997)

The three categories based on the underlying epistemology are *positivist*, *interpretive* and *critical* (Chua 1986 in Myers 1997). Each of the categories is associated with different traditions in social theory and diverse research techniques (Neuman 2000).

Positivist

Myers (1997) describes positivist research as having measurable properties, which are independent of the researcher and instruments. Burns (2000) elaborates that research is positivist if there is evidence of quantifiable measures of variables, hypothesis testing and the drawing of inferences.

Interpretive

Interpretive research begins with the assumption that the approach to reality is only through social constructions such as language, consciousness and shared meanings (Myers 1997). Interpretive research often uses participant observation and field research and the research is not just the external or observable behaviour of people, but meaningful social action (Neuman 2000).

Critical

Critical research is a mix between the nomotheitic and ideographic approaches. Neuman (2000) defines critical research as a

> … critical process of inquiry that goes beyond surface illusions to uncover the real structures in the material world in order to help people change conditions and build a better world for themselves.

Strengths of qualitative research

1. Insiders' view of the field – maintain close association with both participants and activities within the setting, the researcher has to maintain close association with both participants and activities within the setting (Burns 2000).
2. Proximity to the field – qualities of social and educational interaction too often missed by the scientific, more positivistic inquiries (Burns 2000).

Limitations of qualitative research (Burns 2000)

1. Contexts, situations, events, conditions and interactions cannot be replicated to any extent.
2. Subjective nature of a participant's perspective and understandings is not suitable to the scientific criteria.
3. Time required for data analysis collection and interpretation.

3.2.2 Quantitative research

The main features of quantitative research (Neuman 2000) are:

1. tests hypothesis with which the researcher begins;
2. concepts are in the form of distinct variables;
3. measures are systematically created before data collection and are standardised;
4. data are in the form of numbers from precise measurement;
5. theory is largely causal and is deductive;
6. procedures are standard, and replication is assumed; and
7. analysis proceeds by using statistics, tables, or chards and discussing how what they show relates to hypotheses.

Positivism

Neuman defines *positivism* as the approach of the natural sciences. Positivism assumes cold, observable facts, quite distinct from ideas, values, or theories (Neuman 2000). The positivists emphasised the role of discrete and distinct steps on the path to knowledge as the best way of discovering things (Burns 2000). According to the positivists, science is based on deduction (Burns 2000).

Strengths of quantitative research

1. Control is achieved through sampling and design and precision through quantitative and reliable measurement (Burns 2000).
2. Experimentation is an excellent vehicle for the controlled testing of causal processes (Babbie & Mouton 2001).
3. Hypotheses are tested through a deductive approach, and the use of quantitative data permits statistical analysis (Neuman 2000).

Limitations of quantitative research

1. Control – human beings have varying perceptions, and act differently in the same situation (Burns 2000).
2. Quantification does not take into account peoples' experiences (Babbie & Mouton 2001).

3.3 RESEARCH APPROACH

A quantitative research design was selected for the purposes of this study because it displays the following features:

- hypothesis testing – the author could systematically create a hypothesis and subject it to an empirical test;
- concepts were in the form of distinct variables (the standardised test – the independent variable, and treatment, race, gender, home-language – dependent variables);
- measures were systematically created before data collection and are standardised;
- data are in the form of numbers from measurement of learners' achievement;
- theory is largely causal and is deductive from the measurements. The author moved from general kinds of statements to particular ones.
- replication – the data obtained in the experiment should be reliable and the same result has to be found if the study is repeated; and
- analysis was done by using statistics, tables, or charts and discussions on how what they show relates to hypotheses, which enables the author to obtain the measurements and analysis of the properties of the phenomenon under investigation.

3.4 RESEARCH POPULATION

The target population included all first-year learners registered for Business Information Systems at Peninsula Technikon. The population for this study was 450 (according to figures from Peninsula Management Information Systems, April 2004). Participants were learners who had registered for Business Information Systems 1(Annexure III), Accounting Department, Business Faculty. This population was chosen based upon the following criteria:

1) the author lectured on the subject;

2) ease of access; and

3) an expressed need and interest in the type information that this study could provide. Learners were randomly assigned to available classes through a computer-scheduling programme. Intact classes were taught within a 90-minute period. The classes were taught for two periods a week (Annexure IV).

Four of the classes (experimental – as shown in Figure 3.2) were exposed to electronic formative assessment for an additional two hours per week as well as instructional teaching. The other four classes (control – as shown in Figure 3.2) had no formative online assessment, only instructional teaching. The subjects used in the sample population for this study consisted of all respondents to the questionnaire. Some of the respondents belonged to the control group, and others belonged to the experimental group (formative online assessment).

3.5 RESEARCH INSTRUMENTS

In order to obtain data to construct a meaningful representation of the phenomena, the relationship between electronic formative assessment and learner achievement was divided into three categories: technological background, online learning and assessment. The following instruments were utilised:

1. standardised tests for all learners enrolled for Business Information Systems;

2. a questionnaire for gathering information to determine the demographic data, technological background and online experience of the respondents; and
3. experimental design, where the participants were divided into two groups: one group would be administered with the treatment and the other would be the control group without the treatment.

3.5.1 Standardised tests

All learners were administered with standardised summative assessments (Annexure V – Assessment Schedule) in the first two units of Business Information Systems. The standardised tests were based on the assessment criteria in the curriculum of Business Information Systems Module 1 (Annexure VI). The first unit is a practical component on the navigation of the desktop and file management techniques. The second unit is a theory component, comprising of theory of software and hardware elements of a computer. The scores for these tests were obtained from the Peninsula Management Information System

3.5.2 Questionnaires

Definition and nature of questionnaires

According to Burns (2000), a questionnaire is the most commonly used descriptive method in educational research. Bell (1987) states that

> A survey will aim to obtain information from a representative selection of the population and from that sample will then be able to present the findings as being representative selection of the population. The survey is used to obtain information, which can be analysed, and patterns extracted and comparisons made.

Gorard (2001) asserts that technology-based, self-administered questionnaires are preferable for those respondents, who are literate, well motivated, and who have no clear need for individual attention. He elaborates by indicating his preference for the delivery by the researcher to natural groups of respondents, such as school classes (Gorard 2001).

Characteristics of questionnaires (Burns 2000)

- A questionnaire requires a sample of respondents to reply to a number of standard questions under comparable conditions;
- it can be administered by an interviewee, mail, and Internet or by telephone;
- the respondents represent a defined population;
- the results can be generalised to the defined population; and
- the use of standard questions makes comparisons of individuals possible.

Construction of the questionnaire

The construction of the questionnaire was based on an early review of the literature and surveys conducted by the Cape Town City Council on the residents of Western Cape. The instrument was also developed to include areas on previous computer experience of the respondents, computer training and their online experiences. According to Gorard (2001), a key decision affects the likely response rate, cost, speed, sample size on how to deliver it to the sample. The questionnaire was done by technology-based delivery (Gorard 2001). The questionnaire was placed on the faculty intranet, the learners were asked to download the questionnaire, to complete it and to e-mail the completed questionnaire to the author.

3.5.3 Experimental research

Experimental research uses the logic and principles found in natural science research. Experiments can be conducted in laboratories or in real life (Neuman 2000). Under this approach, the researcher divides the people being studied into two or more groups (Gorard 2001). Gorard (2001) states that in the control group or experimental design,

> … the researcher creates two (or more) 'populations' by using different treatments with two samples … Each sample becomes the treatment group … The treatment is known as the 'independent' variable, and the researcher selects a post-treatment test (or measure) known as the 'dependent' variable. Usually one group will receive the treatment and be termed the experimental group and another will not receive the treatment and be termed the control group.

In this study, the respondents were divided into groups according to their prior computer usage. Figure 3.2 below demonstrates how the treatment was used on the experimental group.

The experimental research design was used on a group of learners who had registered for Business Information Systems Module 1 (Appendix III). The treatment for the experimental group comprised of using a formative online learning assessment. The control group was not exposed to the treatment. The post-treatment test will be the standardised summative assessment; and the scores of the test were the dependent variable. Independent variables included the treatment condition, race, gender and home language.

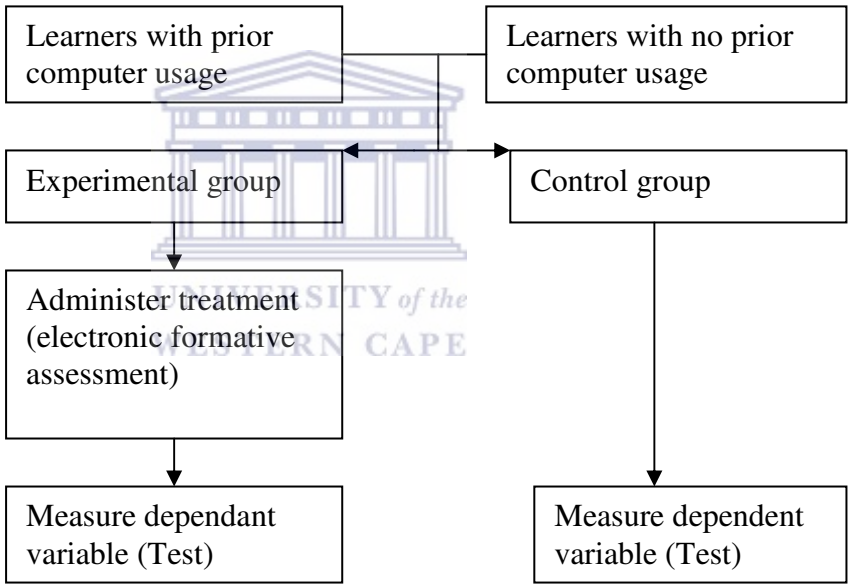


Figure 3.3. Experimental design

3.6 VALIDITY AND RELIABILITY

Factors such as learner gender, race/ethnicity and home language are intervening variables that could have an impact on the external validity of this study. Educator

effects on learners in both the control and experimental groups can interact to confound results. These effects may include:

- the educator's quality of implementation of the treatment condition;
- quality of instructional delivery, and
- learner rapport.

All or any of these educator effects can interact with the treatment condition to mask or exaggerate results of the study.

3.7 RESEARCH HYPOTHESES

The word *hypothesis* is generally used in a rather restricted sense in research to refer to conjectures that can be used to explain observations (Burns 2000). A hypothesis is a hunch, an educated guess that is advanced for the purpose of being tested (Neuman 2000). Hypotheses are the working instruments of theory.

The general hypothesis of this research was that, when compared to a traditional, behaviourist classroom, the enriched constructivist-learning environment by making use of computerised formative assessments would result in significantly greater improvements in learner achievement. Based on the general hypothesis and the nature of the proposed study, the following specific hypotheses were formulated.

> ***Hypothesis 1***: The learner achievements of those learners who have used a computer before attending campus are much higher than those learners who did not.

> ***Hypothesis 2***: The learner achievements of those learners who received treatment in the experimental group are much higher than the control group who did not receive treatment.

3.8 DATA ANALYSIS

Data was quantitatively analysed by means of tables, percentages, graphs and explanations. The aim of analysing the data in tables and graphs is to provide a condensed picture of the data collected and to give adequate coverage in words. The tables will show how evidence was collected by the author. According to Neuman (2000), data analysis is a search for patterns in data. Once these patterns are found, they must be interpreted by means of tables and percentages.

3.9 ETHICAL CONSIDERATIONS/ISSUES

Neuman (2000) explains that the researcher has an obligation to be ethical, even when the research subjects are unaware of or unconcerned about ethics.

The author is a lecturer at the Cape Peninsula University of Technology and at the time that the research was planned and conducted, the institution was named Peninsula Technikon. Permission to conduct the study was granted by the head of Department of Accounting in the Business Faculty. The author included a letter (Annexure I), which formed part of the questionnaire (Annexure II), which briefed the learners about the study and asked for consent. Consent was obtained by the time the learners had completed and returned the questionnaire.

Neuman (2000) states that informed consent is a "fundamental ethical principle of social research". With informed consent, it is likely that the research results would not be negatively influenced, as participants would be well informed about the study (Neuman 2000). Confidentiality and anonymity were guaranteed in an effort to uphold research principles and to maintain respondents' rights and values (Babbie & Mouton 2001). Information disclosed was treated confidentially. Burns (2000) defines *confidentiality* as "the ability of the researcher to keep disclosed information from others".

3.10 CONCLUSION

This chapter focused on a study of the use of electronic formative assessment on learner achievement. The author explained the research design and methodology, the research population, the research instruments, the research hypotheses, data analysis and ethical considerations and the conclusion.

The following chapter presents the research results, and covers aspects such as demographic information, technological and online learning background, and the hypotheses.

CHAPTER 4
RESULTS

This chapter is organised in the following manner:

(1) The introduction will briefly describe the statistical tests used for analysis;

(2) Demographic, technological background and online learning data will precede the hypothesis;

(3) Each hypothesis will be presented with results, and discussion; and

(4) Observations will close the chapter.

4.1 INTRODUCTION

There were two data collection components. Firstly, all learners were administered with summative tests during the first semester as part of the Assessment Schedule (Appendix V). The scores for Test 1 and Test 2 of the Assessment Schedule were used to determine the differences between control and experimental groups. The Test 1 scores were also used to measure the digital divide in respect of technological background, computer usage, gender, race and home language of learners. Secondly, learners were asked to complete questionnaires.

A one-way analysis of variance (ANOVA) was used to compare the means of the scores for Test 1, File Management and Test 2, Theory on the dependent variables, gender and race, to:

1) determine whether there was a difference between the scores of those who used a computer prior to coming to the technikon and those who did not; and
2) determine whether there was a difference between the scores of the experimental and control group.

It was predicted that scores from those who used a computer prior to coming to the technikon and those who received treatment in the experimental group would have higher means. A probability level of .05 was used in all statistical tests. Due to the

extreme sample size differences present in the subpopulations, the Kruskal-Wallis multiple-comparison Z-value test was also used. The research hypotheses were tried against the collected data.

All returned questionnaires were examined for completeness and accuracy. The data collected was in the form of nominal data. *Nominal data* is data reported as frequencies in categories as opposed to *ordinal data* which lies on a continuum. Upon return, the questionnaires were entered into the computer using database software (Microsoft Access™) and exported into a spreadsheet (Microsoft Excel™). A contingency table was constructed for each section of data that applied to the hypothesis. Descriptive and inferential statistics were used to analyse the data by using the statistical software package SPSS™.

4.2 DEMOGRAPHIC DATA

Learners' age, gender, race, home language and type of school attended were tabulated by frequency and percentage. Table 4.1 reports these counts and percentages. Of the 185 who responded, 93.48% were between the ages of 19 and 22, 64.32% were female, 66.49% were black, and 55.14% reported their home language as IsiXhosa. The highest percentage, 71.04%, had attended government schools (See Table 4.1).

Table 4.1. Demographic data of respondents

Item	Count	Percentage	Item	Count	Percentage
Gender			**Home language**		
Female	119	64.32%	Afrikaans	39	21.08%
Male	66	35.68%	English	22	11.89%
Race			Isixhosa	102	55.14%
Black	123	66.49%	Isizulu	3	1.62%
Coloured	61	32.97%	Sepedi	5	2.70%
Indian	1	0.54%	Sesotho	7	3.78%
Type of school			Setswana	6	3.24%
Farm school	1	0.55%	Siswati	1	0.54%
Govt. school	130	71.04%	**Age**		
Model C school	28	15.30%	17-19	105	57.07%
Private school	13	7.10%	20-22	67	36.41%
Village school	11	6.01%	23-25	10	5.43%
			26+	2	1.09%

*Counts may not total 185 due to some respondents not answering the question.

4.3 TECHNOLOGICAL BACKGROUND

Sixty-nine percent of the respondents reported access to computers for personal or school use prior to attending the technikon. First time access to a computer was at the following points: college, community centre, family, friend, home, school, Internet café and library. Fifty-five percent of the respondents had first had access to the computer at school, 23% at home and 12% at a college. Figure 4.1 shows the percentage of respondents' first access to computers.

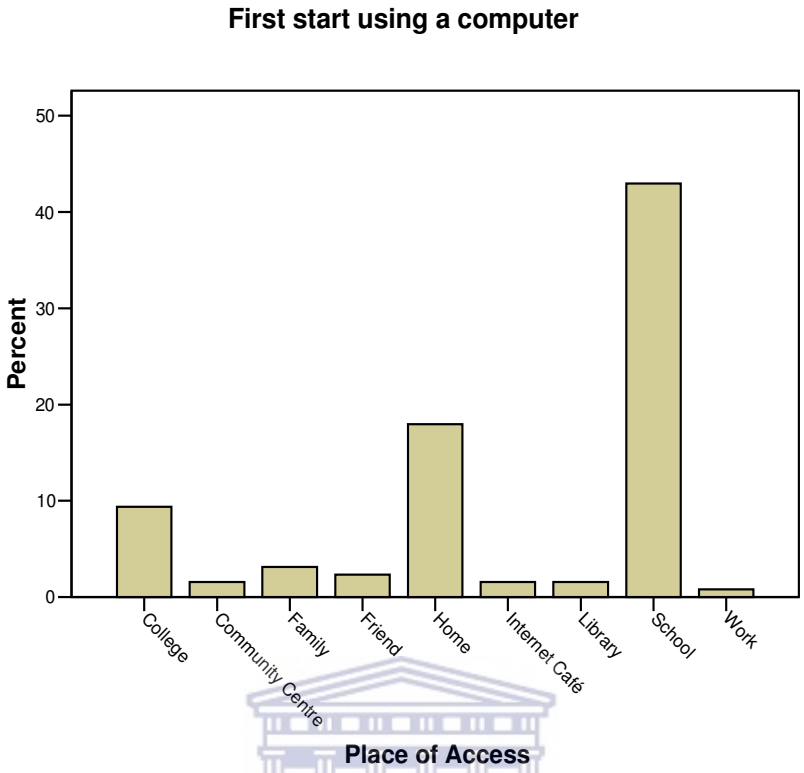


Figure 4.1. Point of access; Community centre; Internet Café

Ownership of amenities

In order to examine differences in the adoption of available technologies, the percentage of learners accessing each technology was analysed.

Sixty-one percent of the respondents indicated that they have a telephone at their place of residence, 85% possess a radio, 81% a television set, 60% a cell phone, 20% a computer and 3.8% access to the Internet. Figure 4.2 shows access to amenities:

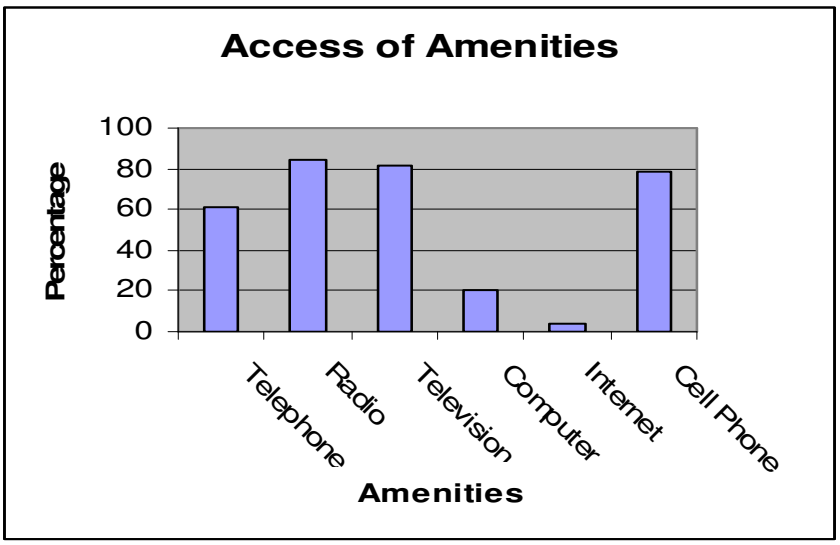


Figure 4.2. **Access to amenities, cell phone**

Cell phone usage

Respondents were asked to indicate how they used their cell phones. Fifty-eight percent indicated that they played games, 90% send SMSs (short messaging service), 92% make calls and all learners receive calls on their cell phones. Figure 4.3 shows the major use of cell phones by respondents.

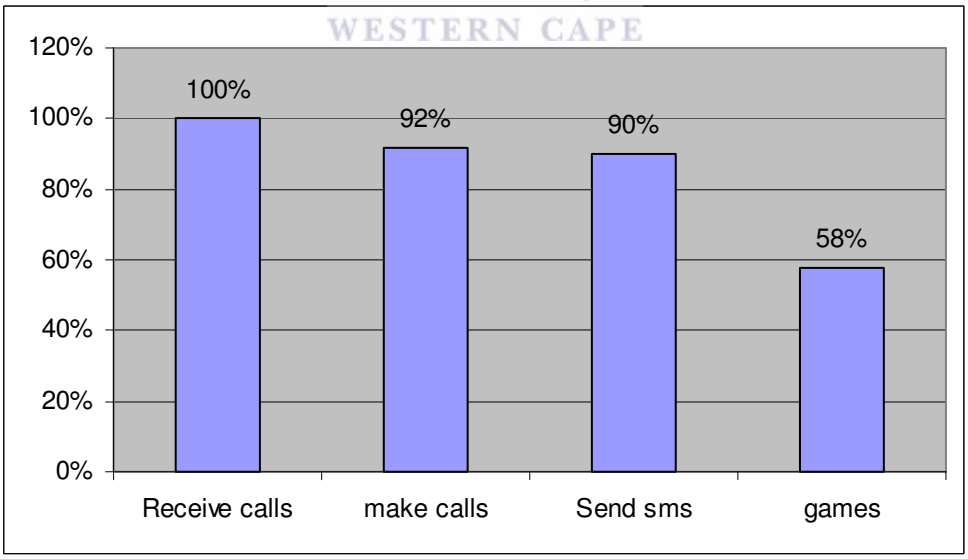


Figure 4.3. **Make calls; send SMS; Games**

E-mail

Thirty-four percent of the respondents reported using e-mail prior to attending the technikon. Access to a computer was obtained at the following: college, community centre, family, friend, home, school, Internet café and library. Figure 4.4 shows the percentage of respondents' usage of e-mail.

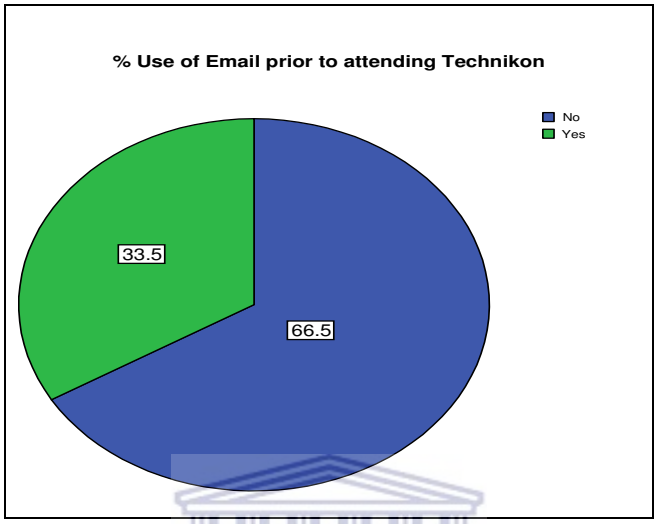


Figure 4.4 **Percentage usage of e-mail**

ATM usage for the first time

Seventy-seven percent of the respondents reported using an automatic teller machine (ATM) prior to attending the technikon. Respondents were asked to rate their feelings the first time they used the ATM. Figure 4.5 shows the percentages of how respondents felt when using an ATM for the first time.

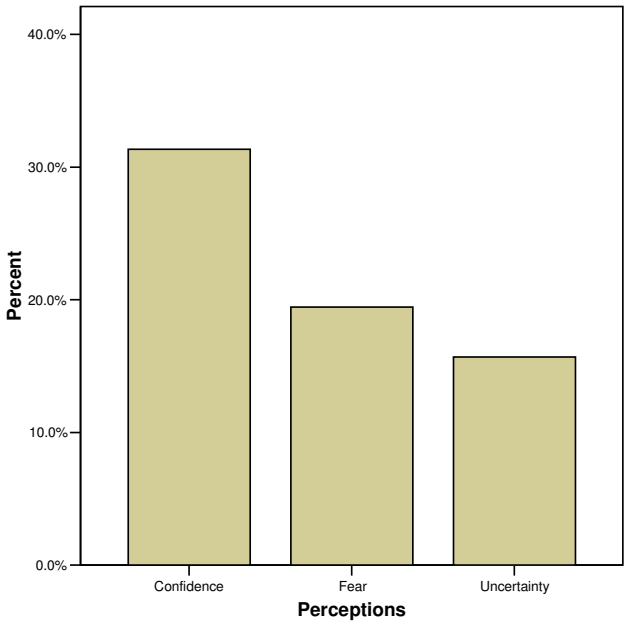


Figure 4.5. Perceptions when using an ATM for the first time

Conclusion

Sixty-nine percent of the respondents reported having access to computers for personal or school use prior to attending the technikon. Fifty-five percent of those respondents, who had used a computer, had accessed a computer at school. Twenty percent of all respondents owned a computer and 3.8% had access to the Internet. Eighty percent of all respondents owned a cell phone and 58% had used a cell phone to play games. Only 34% of all respondents had used e-mail prior to attending the technikon and 77% had used the ATM. Fifty percent of the respondents were afraid and uncertain when they used the ATM for the first time.

The File Management test results (Annexure VII) were used to measure whether the technological background had an effect on learner achievement. The choice of using File Management as a measurement was because of the practical nature of the test. The aim of the analysis was to investigate whether there were significant differences between those who had access to technology and those who had not. The eight subgroups were divided as follows:

Table 4.2 Descriptive statistics of the eight sub-groups

Classification description	Abbreviation
Black Female use of technology No	B_F No
Black Female use of technology Yes	B_F Yes
Black Male use of technology No	B_M No
Black Male use of technology Yes	B_M Yes
Coloured Female use of technology No	C_F No
Coloured Female use of technology Yes	C_F Yes
Coloured Male use of technology No	C_M No
Coloured Male use of technology Yes	C_M Yes

The use of a telephone (see Fig. 2, Annexure VII), television (see Fig. 3, Annexure VII), radio (see Fig. 4, Annexure VII), cell phone and Internet showed no significant differences between the scores in the different groups.

The use of a photocopier (see Fig. 9, Annexure VII) showed an improvement in marks compared to those learners who had not used a photocopier. This was evident in the black male learners, coloured male learners and coloured female learners.

The use of an ATM (see Fig. 10, Annexure VII) showed an improvement in marks compared to those learners who had not used an ATM. This was evident for black female and black male learners, but there were no differences for the coloured learners.

The use of a fax machine (see Fig. 11, Annexure VII) showed an improvement in marks for those who had used a fax machine as compared to those who had not. This was evident in all learners except coloured male learners.

The use of a printer (see Fig. 12, Annexure VII) showed an improvement in marks for black male and female learners who had used a printer.

The use of e-mail (see Fig. 13, Annexure VII) showed an improvement in marks only in black female learners and coloured female learners who had prior use of e-mail.

4.4 ONLINE LEARNING

Respondents were asked if their usage of computers had changed since the increased emphasis on online learning. Respondents were asked to indicate whether the online learning assisted their learning. In this case, 94.05% learners indicated that it did assist them in learning and 5.95% indicated that it did not. Figure 4.6 shows the percentage of learners assisted in learning.

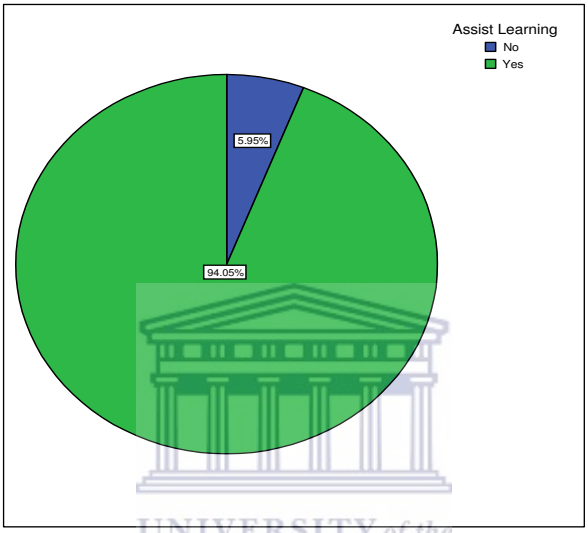


Figure 4.6. Assist learning.

Learners were asked to rate their overall computer expertise at the technikon. Five respondents (10%) indicated they were excellent, 32 (60%) said their expertise was good, 14 (26%) average and 2 (3%) rated themselves as poor. Figure 4.7 shows how respondents rated their expertise:

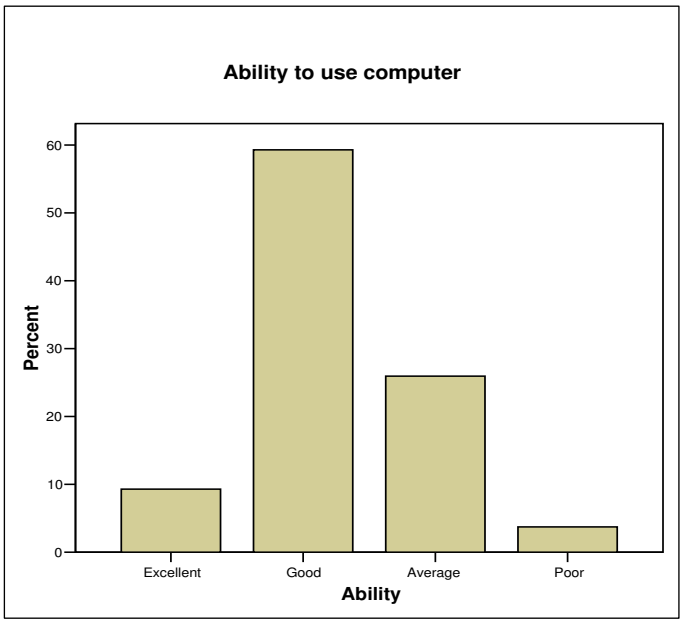


Figure 4.7. Computer expertise

Ninety-nine percent of the learners indicated that they had a positive experience with online learning although they did have certain difficulties. Three (6%) of the learners indicated that they had a problem with the size of the font on the screen, 19 (35%) experienced a problem with understanding the instructions, 2 (3%) had difficulty with understanding the language and 19 (35%) had no difficulties. Eighty percent experienced technical problems with the software. Figure 4.8 shows the difficulties experienced by learners with online software:

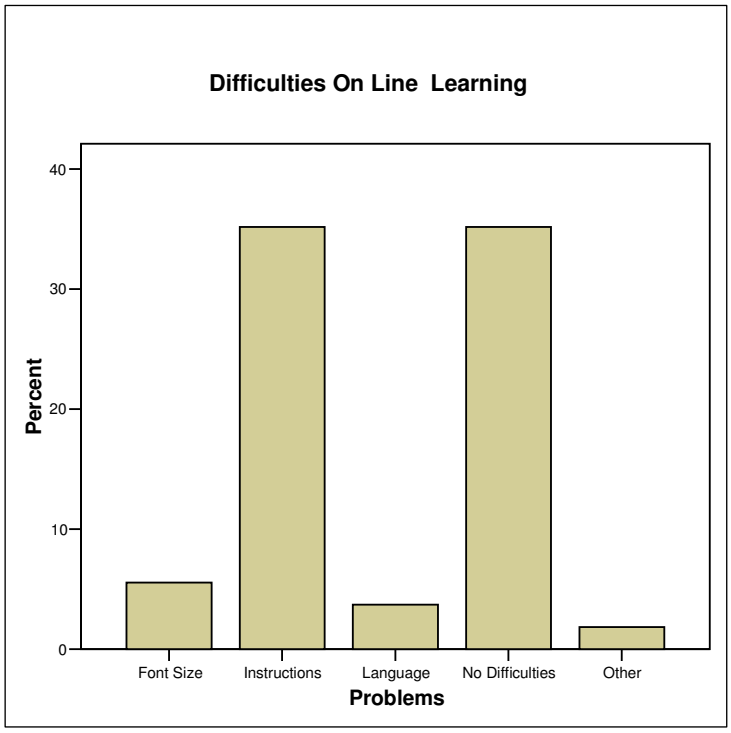


Figure 4.8. Difficulties with online learning

When asked to rate the level of difficulty of their online assessments, 1 (2%) indicated the assessments to be very difficult, 17 (32%) very difficult, 32 (60%) easy and 3 (6%) very easy. 33 (67%) indicated that they would prefer to do electronic assessments in other subjects in their Accounting Diploma. Figure 4.9 shows learners' perceptions of online assessment.

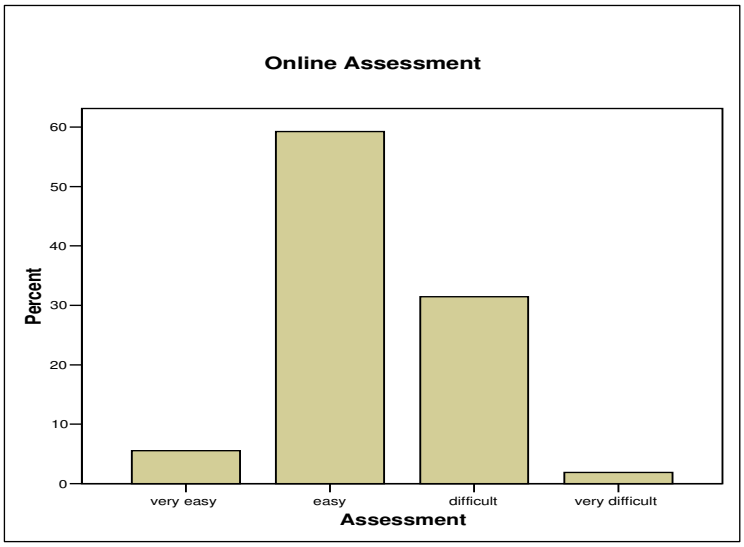


Figure 4.9. Online assessment

When asked to indicate how online learning helped learners to understand the usefulness of the Microsoft Office program, 57% indicated that their understanding of Excel had improved, 45% for Internet, 39% for Access and 50% had found an improvement in Word. Figure 4.10 shows the percentage of learners that found the different Microsoft office programs useful.

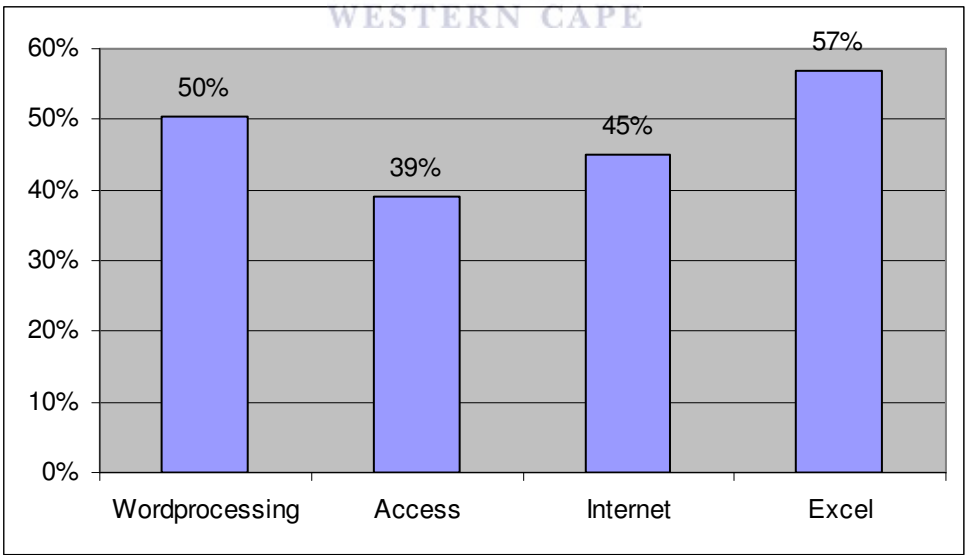


Figure 4.10 Usefulness of Microsoft Office programs

Conclusion

Ninety-four percent of the respondents indicated that online learning assisted their learning. Sixty percent of the respondents rated their expertise as good. Thirty-five percent of the respondents had a problem with comprehending the instructions of the software program. Sixty percent of the respondents found the online assessments to be easy. Fifty-seven percent of the respondents indicated that their understanding of Microsoft Excel had improved with the online learning.

4.5 HYPOTHESIS 1

The first hypothesis stated that the learner achievements of those learners who have used a computer before attending campus would be much higher than those learners who did not. In this hypothesis, the Test 1 File Management and Test 2 Theory within the eight subgroups were examined.

4.5.1 Test 1 File management

Analysis of variance (ANOVA) was used on Test 1 Practical scale scores (File Management). The measurement File Management implies the marks obtained in the standardised test. The classifier or grouping variable was formed by means of the combination of race, gender and the prior use of a computer. The aim of the analysis was to investigate whether any two medians of the eight subgroups were statistically different. The eight subgroups were divided as follows:

Table 4.3. Description of the eight sub-groups

Classification description	Abbreviation	Long abbreviation
Black Female Computer	B_F_C	Blc_Fem_Comp
Black Female No Computer	B_F_NC	Blc_Fem_NoComp
Black Male Computer	B_M_C	Blc_Mal_Comp
Black Male No Computer	B_M_NC	Blc_Mal_NoComp
Coloured Female Computer	C_F_C	Col_Fem_Comp
Coloured Female No Computer	C_F_NC	Col_Fem_NoComp
Coloured Male Computer	C_M_C	Col_Mal_Comp
Coloured Male No Computer	C_M_NC	Col_Mal_NoComp

The results of the analysis are given in the tables below.

Table 4.4. Descriptive statistics of the eight subgroups

(Group abbreviations explained above)

Group	Count	Mean	Median	Standard deviation
Blc_Fem_NoComp	36	44.2	40	26.23
Blc_Mal_NoComp	14	44.3	40	24.72
Blc_Fem_Comp	50	52.6	55	26.40
Col_Mal_NoComp	6	63.3	70	23.38
Blc_Mal_Comp	23	64.8	70	30.73
Col_Mal_Comp	22	75.9	80	20.85
Col_Fem_Comp	28	77.1	80	19.79
Col_Fem_NoComp	5	78.0	90	16.43

Tests of assumptions

Assumption	Test value	Prob. level	Decision (0.05)
Skewness normality of residuals	-1.5168	0.129320	Accept
Kurtosis normality of residuals	-1.2018	0.229432	Accept
Omnibus normality of residuals	3.7450	0.153737	Accept
Modified-Levene equal-variance test	1.8595	0.078847	Accept

The box plot (Fig. 4.11) shows the range and the interquartile range of the means of the eight subgroups.

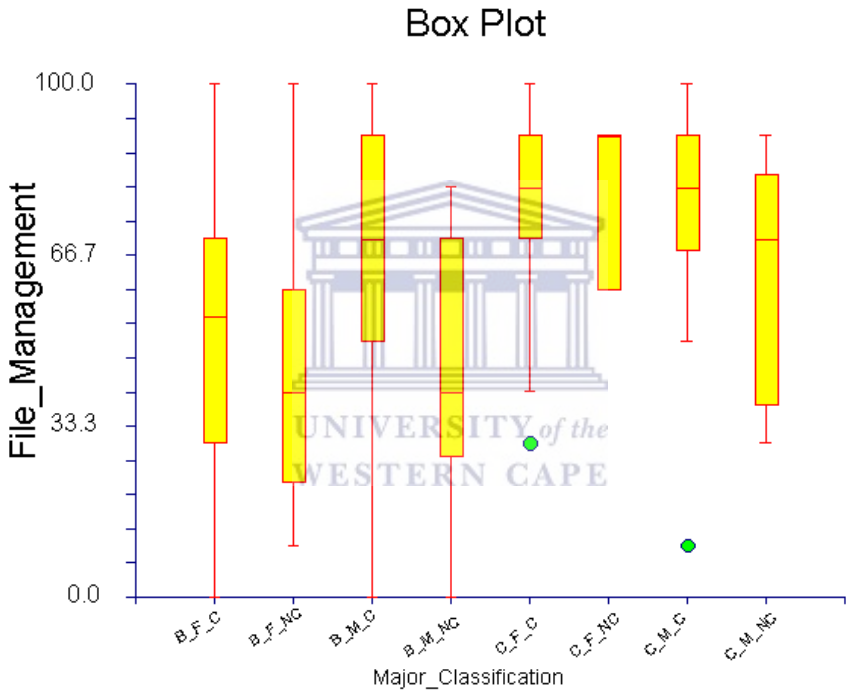


Figure 4.11 Box Plot; File Management; Major classification

From Figure 4.11 above it was clear that there were differences between the medians of the eight categories. Pairwise comparisons among the groups were conducted using the Kruskal-Wallis test, the nonparametric version of the analysis of variance (ANOVA). It was used to compare the means of the eight subgroups. The analysis is calculated from

the pairwise comparisons among the groups and the resulting significance is determined by a comparison of ranked values with the expected values using a chi-square analysis.

Kruskal-Wallis One-Way ANOVA on ranks

Statistical hypotheses

Ho: All medians are equal.
Ha: At least two medians are different.

Test results

Method	DF	Chi-square (H)	Prob. level	Decision(0.05)
Not corrected for ties	7	41.47807	0.000001	Reject Ho
Corrected for ties	7	42.01587	0.000001	Reject Ho

Results from the chi-square analysis rejected the null hypothesis (Ho), which indicates that at least two medians were significantly different.

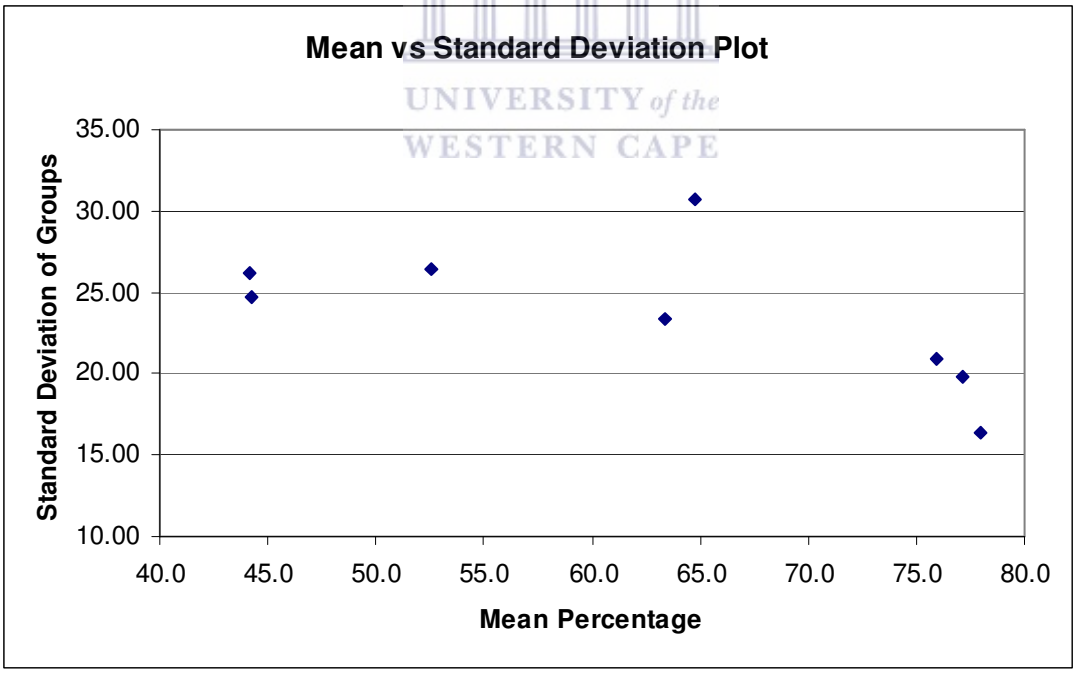


Figure 4.12 Standard Deviation Plot; Mean percentage; File Management

The standard deviations (SD) form an approximate curvilinear (quadratic) relationship with the mean percentages in that the SD reached a peak between 50 to 65 percent for the File Management test. There was an expected downward trend of the SDs towards the higher percentages, due to the censoring of the maximum percentage score (namely 100%) for coloured males with no computers.

The subpopulation sample sizes vary from five for the *coloured female no computer* group to fifty for the *black female computer* group (See Table 4.4). Due to the extreme sample size differences present in the subpopulations to be compared, it would be difficult to apply ordinary multiple-comparison methods to rank the different subpopulations.

For the eight distinct groups (subpopulations) it was possible to perform 28 pairwise comparisons. The results of these 28 comparisons were summarised in the Kruskal-Wallis multiple-comparisons. Ten of the 28 pairwise comparisons were significantly different and supplied some indication of which groups differed with respect to their medians (see Table 4.5).

Table 4.5. Kruskal-Wallis multiple-comparison Z-value File Management

	Blc_Fem_NoComp	Blc_Mal_NoComp	Blc_Fem_Comp	Col_Mal_NoComp	Blc_Mal_Comp	Col_Mal_Comp	Col_Fem_Comp	Col_Fem_NoComp
Black Female No Computer	0	0.026	1.327	1.501	2.880	4.269	4.777	2.539
Black Male No Computer	0.026	0	0.986	1.373	2.291	3.403	3.702	2.341
Black Female Computer	1.327	0.986	0	0.861	1.900	3.382	3.871	1.965
Coloured	1.501	1.373	0.861	0	0.233	1.071	1.204	0.908

Male No Computer								
Black Male Computer	2.880	2.291	1.900	0.233	0	1.296	1.546	0.898
Coloured Male Computer	4.269	3.403	3.382	1.071	1.296	0	0.170	0.114
Coloured Female Computer	4.777	3.702	3.871	1.204	1.546	0.170	0	0.016
Coloured Female No Computer	2.539	2.341	1.965	0.908	0.898	0.114	0.016	0

Regular test: Medians significantly different if z-value > 1.9600

Bonferroni test: Medians significantly different if z-value > 3.1237

The Kruskal-Wallis test showed differences between the eight subgroups. The test which was corrected for tied ranks, was significant with a chi square = 46.15 and p = 0.001. The most significant differences were found between the coloured female learners with prior computer usage (Col_Fem _Comp) (M = 77.1, SD = 19.79) and the black female learners who had no prior computer usage (Blc_Fem _NoComp) (M = 44.2, SD = 26.23) , coloured male learners with computer usage (Col_Mal _Comp) (M = 75.9, SD = 20.85) and the black female learners who had no prior computer usage (Blc_Fem _NoComp) (M = 44.2, SD = 26.23), and coloured female learners with prior computer usage(Col_Fem _Comp) (M = 77.1, SD = 19.79) and black female learners who had prior computer usage (Blc_Fem _Comp) (M = 52.6, SD = 26.40).

4.5.2 Test 2 Theory

Analysis of variance (ANOVA) was used on Test 2 Theory scale scores (Theory). The measurement *Theory* implies the marks obtained in the standardised test. The

classifier or grouping variable was formed by means of the combination of race, gender and the prior use of a computer. The aim of the analysis was to investigate whether any two medians of the eight subgroups were statistically different. The results of the analysis were given in the tables below.

Tests of assumptions

Assumption	Test value	Prob. level	Decision (0.05)
Skewness normality of residuals	-0.5185	0.604100	Accept
Kurtosis normality of residuals	-1.4048	0.160078	Accept
Omnibus normality of residuals	2.2423	0.325897	Accept
Modified-Levene equal-variance test	1.5095	0.166721	Accept

The box plot (Fig. 4.13) shows the range and the interquartile range of the means of the eight subgroups.

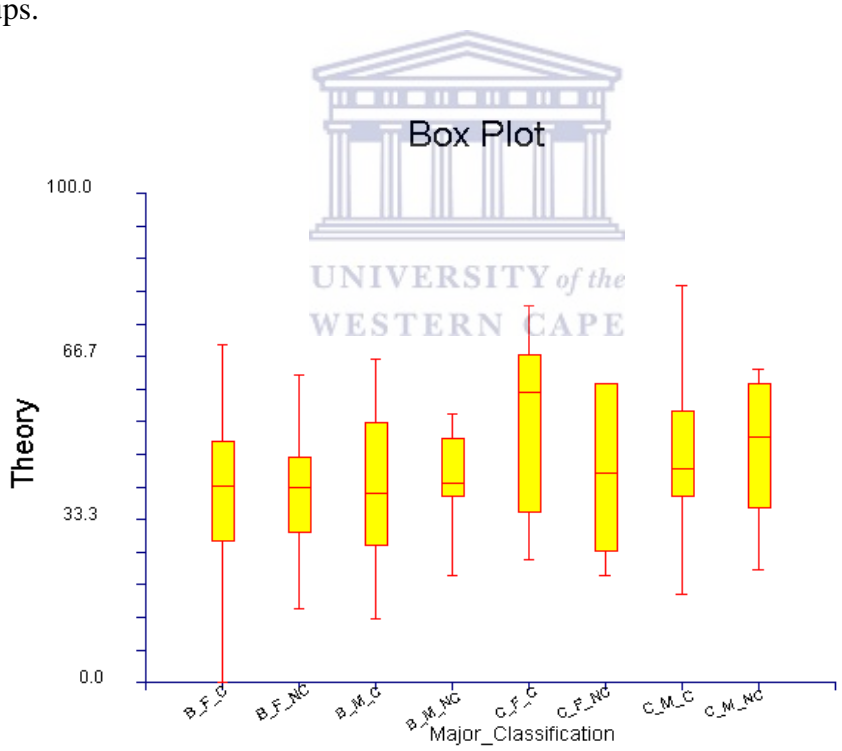


Figure 4.13 **Box Plot; Theory; Major classification**

From Figure 4.13 above it was clear that there were differences between the medians of the eight categories. Pairwise comparisons among the groups were conducted using the Kruskal-Wallis test, the nonparametric version of the analysis of variance (ANOVA). It was used to compare the means of the eight subgroups. The analysis is calculated from the pairwise comparisons among the groups and the resulting significance is determined by a comparison of ranked values with the expected values using a chi-square analysis.

Kruskal-Wallis One-Way ANOVA on ranks

Statistical hypotheses

Ho: All medians are equal.

Ha: At least two medians are different.

Test results

Method	DF	Chi-square (H)	Prob. level	Decision(0.05)
Not corrected for ties	7	15.49889	0.030110	Reject Ho
Corrected for ties	7	15.51015	0.029989	Reject Ho

Results from the chi-square analysis rejected the null hypothesis (Ho), which indicates that at least two medians are significantly different.

Table 4.6. Descriptive statistics of the eight subgroups

Group	Count	Means	Median	Standard Deviation
Blc_Fem_Comp	50	39.06	40.5	14.21
Blc_Fem_NoComp	36	40.33	40.0	11.85
Blc_Mal_Comp	23	40.61	39.0	15.49
Blc_Mal_NoComp	14	42.64	41.0	8.71
Col_Fem_NoComp	5	43.80	43.0	17.37
Col_Mal_Comp	22	46.23	44.0	13.78
Col_Mal_NoComp	6	48.00	50.5	15.11
Col_Fem_Comp	28	52.93	59.5	16.80

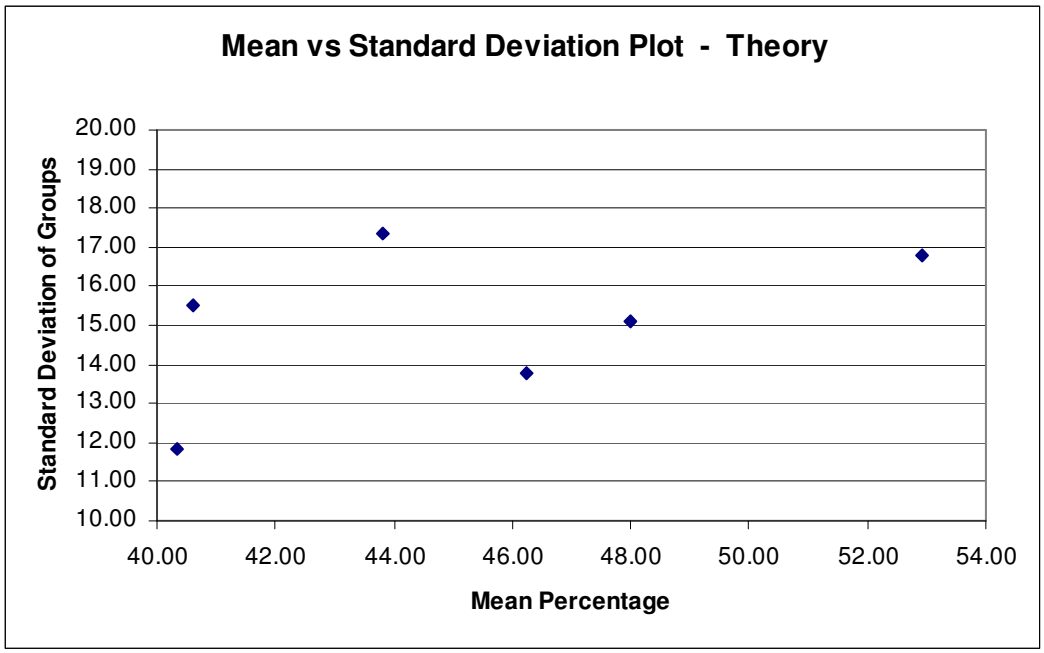


Figure 4.14 Standard Deviation Plot; Mean percentage

The most important deduction that could be made from Figure 4.14 was that the mean percentages obtained within the eight subgroups had a narrow range with a minimum of 40% and a maximum of 54%, approximately. With such a narrow range one does not expect many significant differences between the means or medians of the eight distinct subgroups.

For the eight distinct groups (subpopulations) it was possible to perform 28 pairwise comparisons. The results of these 28 comparisons were summarised in the Kruskal-Wallis multiple-comparisons. Three of the 28 pairwise comparisons were significantly different and supplied some indication of which groups differed with respect to their medians. The number of differences was much less than for the File Management scores due to the narrow range of the group medians.

Table 4.7. Kruskal-Wallis multiple-comparison Z-value Theory

	Blc_Fem _Comp	Blc_Fem _NoComp	Blc_Mal _Comp	Blc_Mal _NoComp	Col_Fem _NoComp	Col_Mal _Comp	Col_Mal _NoComp	Col_Fem _Comp
Black Female Computer	0	0.305	0.239	0.832	0.588	1.743	1.444	3.416
Black Female No Computer	0.305	0	0.024	0.587	0.438	1.401	1.264	2.936
Black Male Computer	0.239	0.024	0	0.565	0.436	1.293	1.230	2.651
Black Male No Computer	0.832	0.587	0.565	0	0.046	0.568	0.763	1.695
Coloured Female No Computer	0.588	0.438	0.436	0.046	0	0.344	0.575	1.093
Coloured Male Computer	1.743	1.401	1.293	0.568	0.344	0	0.387	1.265
Coloured Male No Computer	1.444	1.264	1.230	0.763	0.575	0.387	0	0.406
Coloured Female Computer	3.416	2.936	2.651	1.695	1.093	1.265	0.406	0

Regular test: Medians significantly different if z-value > 1.9600
Bonferroni test: Medians significantly different if z-value > 3.1237

A Kruskal-Wallis test showed some differences between the 8 subgroups. The test, which was corrected for tied ranks, was significant, with the chi square = 15.51 and p = 0.029. The most significant differences were found between the coloured female learners with prior computer usage (Col_Fem _Comp) (M = 52.93, SD = 16.80) and the

black female learners with prior computer usage (Blc_Fem _Comp) (M = 39.06, SD = 14.21); the coloured female learners with prior computer usage(Col_Fem _Comp) (M = 52.93, SD = 16.80) and black female learners with no prior computer usage (Blc_Fem _NoComp) (M = 40.33, SD = 11.85).

4.6 HYPOTHESIS 2

The second hypothesis stated that the learner achievements of those learners who received treatment in the experimental group would be much higher than the control group who did not receive treatment. In this hypothesis the Test 1 File Management and Test 2 Theory within the four subgroups were examined.

4.6.1 Test 1 File Management

Analysis of variance (ANOVA) was used on Test 1 Practical scale scores (File Management) with regard to the control and the experimental groups. The measurement *File Management* implies the marks obtained in the standardised test. The classifier or grouping variable was formed by means of the combination of control, experimental groups and the usage of a computer. The aim of the analysis was to investigate whether any two medians of the four subgroups were statistically different. The four subgroups were divided as follows:

Table 4.8. Classification description on prior use of computer

Classification Description	Abbreviation
Experimental group with prior computer usage	C_Comp
Experimental group with no prior computer usage	C_NoComp
Control group with prior computer usage	P_Comp
Control group with no prior computer usage	P_NoComp

The results of the analysis are given in the tables below.

Table 4.9. Descriptive statistics of the four subgroups.

(Group abbreviations explained above)

Group	Count	Mean	Median	Standard deviation
P_NoComp	27	48.14	50	23.38
C_NoComp	34	49.41	45	26.16
P_Comp	48	63.33	70	27.6
C_Comp	75	65.47	70	27.62

Tests of assumptions section

Assumption	Test value	Prob. level	Decision (0.05)
Skewness normality of residuals	-2.1472	0.031774	Reject
Kurtosis normality of residuals	-2.9219	0.003479	Reject
Omnibus normality of residuals	13.1480	0.001396	Reject
Modified-Levene equal-variance test	0.1024	0.958530	Accept

The box plot (Fig. 4.15) shows the range and the interquartile range of the means of the four control and experimental subgroups.

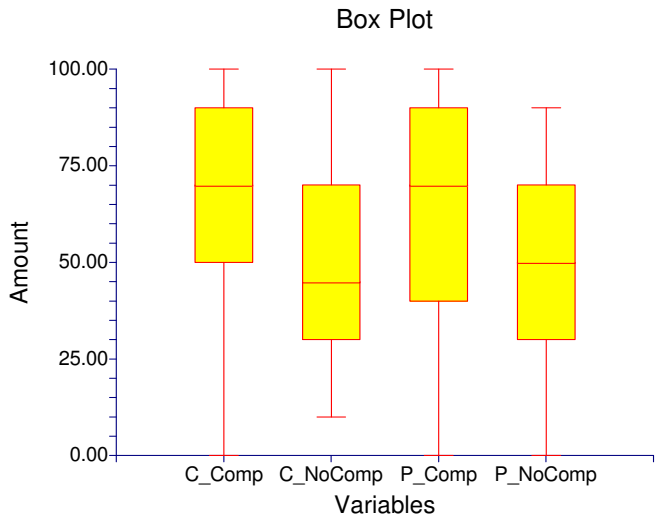


Figure 4.15 Box Plot; File Management; Control and Experimental groups

From Figure 4.15 above it was clear that there were differences between the medians of the four categories. Pairwise comparisons among the groups were conducted using the Kruskal-Wallis test, the nonparametric version of the analysis of variance (ANOVA). It was used to compare the means of the four subgroups. The analysis is calculated from the pairwise comparisons among the groups and the resulting significance is determined by a comparison of ranked values with the expected values using a chi-square analysis.

Kruskal-Wallis One-Way ANOVA on ranks

Statistical hypotheses

Ho: All medians are equal.

Ha: At least two medians are different.

Test results

Method	DF	Chi-square (H)	Prob. level	Decision(0.05)
Not corrected for ties	3	13.77037	0.003235	Reject Ho
Corrected for ties	3	13.94891	0.002976	Reject Ho

Results from the chi-square analysis rejected the null hypothesis (Ho), which indicates that at least two medians are significantly different (P<0.05).

Figure 4.16 below depicts the way the means vary between the control and experimental subgroups.

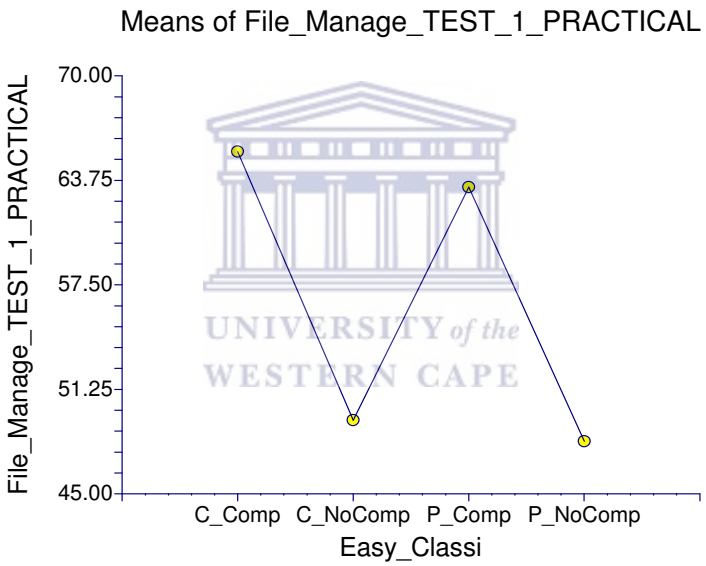


Figure 4.16 Means Plot; File Management; Control and Experimental group

The most important deduction that could be made from Figure 4.16 was that the mean percentages obtained within the four subgroups had a narrow range with a minimum of 48% and a maximum of 65%, approximately. With such a narrow range one does not expect many significant differences between the means or medians of the four distinct subgroups.

For the four distinct groups (subpopulations) it was possible to perform six pairwise comparisons. The results of these six comparisons were summarised in the Kruskal-Wallis multiple-comparisons. However, four of the six pairwise comparisons were different and supplied some indication of which groups differed with respect to their medians.

Table 4.10 Kruskal-Wallis multiple-comparison Z-value control groups

	C_Comp	C_NoComp	P_Comp	P_NoComp
C_Comp	0	2.9153	0.4827	2.8046
C_NoComp	2.9153	0	2.2909	0.1037
P_Comp	0.4827	2.2909	0	2.2457
P_NoComp	2.8046	0.1037	2.2457	0

Regular test: Medians significantly different if z-value > 1.9600
Bonferroni test: Medians significantly different if z-value > 2.6383

The Kruskal-Wallis test showed differences between the four subgroups. The test which was corrected for tied ranks, was significant, with a chi square (N=184) = 13.9489 and p = 0.002976. However, the most significant difference was found within the experimental group, between those who had prior computer usage, (C_Comp) (M = 49.41, SD = 26.16) and those who had not, (C_NoComp) (M = 65.47, SD = 27.62). There was no significant difference between the control and experimental groups.

4.6.2 Test 2 Theory

Analysis of variance (ANOVA) was used on Test 2 Theory scale scores (Theory) with regard to the control and the experimental group. The measurement "Theory" implies the marks obtained in the standardised test. The classifier or grouping variable was formed by means of the combination of control, experimental groups and the usage of a computer. The aim of the analysis was to investigate whether any two medians of the four subgroups were statistically different. The four subgroups were divided as for the File Management test. The results of the analysis are given in the table below:

Table 4.11 Descriptive statistics of the four subgroups

Group	Count	Mean	Median	Standard deviation
C_NoComp	34	36.5	38	26.16
C_Comp	75	39.84	38	27.62
P_NoComp	27	48.70	47	23.38
P_Comp	48	49.95	51	27.6

Tests of assumptions

Assumption	Test value	Prob. level	Decision (0.05)
Skewness normality of residuals	0.8668	0.386072	Accept
Kurtosis normality of residuals	0.8788	0.379498	Accept
Omnibus normality of residuals	1.5236	0.466824	Accept
Modified-Levene equal-variance test	2.6456	0.050597	Accept

The box plot (Fig. 4.17) shows the range and the interquartile range of the means of the eight subgroups.

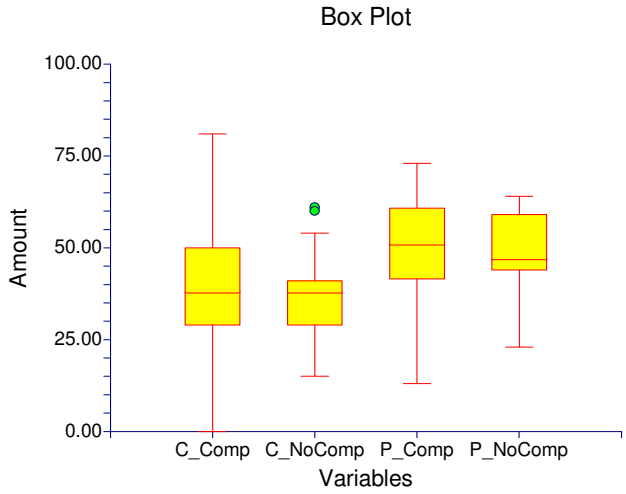


Figure 4.17 Box Plot; Theory; Control and Experimental Groups

From Figure 4.17 above it was clear that there were differences between the medians of the four categories. Pairwise comparisons among the groups were conducted using the Kruskal-Wallis test, the nonparametric version of the analysis of variance (ANOVA). It was used to compare the means of the four subgroups. The analysis is calculated from the pairwise comparisons among the groups and the resulting significance is determined by a comparison of ranked values with the expected values using a chi-square analysis.

Kruskal-Wallis One-Way ANOVA on ranks

Statistical hypotheses

Ho: All medians are equal.

Ha: At least two medians are different.

Test results

Method	DF	Chi-square (H)	Prob. level	Decision(0.05)
Not corrected for ties	3	30.00754	0.000001	Reject Ho
Corrected for ties	3	30.02934	0.000001	Reject Ho

Results from the chi-square analysis rejected the null hypothesis (Ho), which indicates that at least two medians are significantly different (P<0.05).

Figure 4.18 below depicts the way the means vary between the control and experimental subgroups.

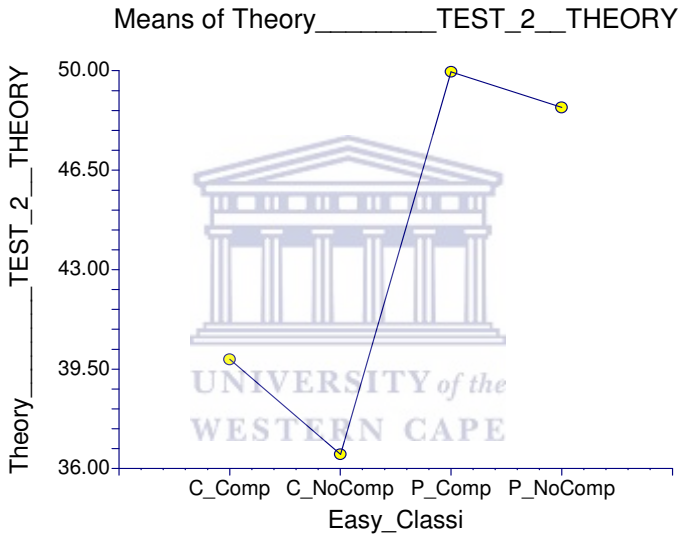


Figure 4.18 Means Plot; Theory; Control and Experimental Groups

The most important deduction that could be made from Figure 4.18 was that the mean percentages obtained within the four subgroups had a narrow range with a minimum of 36% and a maximum of 50%, approximately. With such a narrow range one does not expect many significant differences between the means or medians of the four distinct subgroups.

For the four distinct groups (subpopulations) it was possible to perform six pairwise comparisons. The results of these six comparisons were summarised in the Kruskal-

Wallis multiple-comparisons. However, four of the six pairwise comparisons were significantly different and supplied some indication of which groups differed with respect to their medians.

Table 4.12 Kruskal-Wallis multiple-comparison Z-value test

	C_Comp	C_NoComp	P_Comp	P_NoComp
C_Comp	0	1.0704	4.0283	3.2255
C_NoComp	1.0704	0	4.3091	3.6669
P_Comp	4.0283	4.3091	0	0.0859
P_NoComp	3.2255	3.6669	0.0859	0

Regular test: Medians significantly different if z-value > 1.9600

Bonferroni test: Medians significantly different if z-value > 2.6383

The Kruskal-Wallis test showed significant differences between the four subgroups. The test which was corrected for tied ranks, was significant with the chi square (N=184) = 30.02 and p = 0.000001. However, the most significant difference was found between the experimental group and the control group, (P_Comp) (M=49.95, SD = 27.6) and the (C_NoComp) (M=36.5, SD = 26.16). The control group achieved higher means than the experimental group, which was the opposite for the File Management test. The significant differences were: control group, (P_Comp) (M=49.95, SD = 27.61) and the experimental group, (C_Comp) (M = 39.84, SD = 27.62), (P_NoComp) (M=48.70, SD = 23.38) in the control group and (C_NoComp) (M=36.5, SD = 26.16) in the experimental group.

4.7 CONCLUSION

The first section of this chapter presented data from the questionnaires. The findings revealed the demographic data, technological background and online learning experiences of the respondents.

The second section of this chapter presented quantitative findings on the effects of the independent variables race, gender, and treatment on the dependent variables (Test 1 File Management and Test 2 Theory). ANOVA revealed statistically significant differences between control and experimental group on the Test 2 Theory assessment. ANOVA revealed no statistically significant differences in Test 1 File Management.

CHAPTER 5
DISCUSSION AND CONCLUSION

5.1 INTRODUCTION

The term *gap* is often used to describe a number of different but related meanings, including disparity, difference, divergence, variance, mismatch or inequality. According to Figure 1.1 (Theoretical Framework), the gap refers to the difference between the desired and the actual output at HDIs.

The prevailing problem in HDIs is that gaps are emerging with the throughput rate, graduate output and enrolments. According to a National Plan for Higher Education (DOE 1996b)for higher education, enrolment at these institutions will rise within 15 years from 15% to 20% of school leavers (DOE 2004b). The gaps need to be addressed; the government is concerned about South Africa lagging behind other countries in science and technology. International comparisons have been a driving force behind both national and provincial initiatives to raise academic standards and improve student achievement.

The Department of Education identifies the problems experienced by higher education institutions:

> … numbers of disadvantaged students in the higher education system increased over this period at a higher rate than that of students from advantaged backgrounds. The provision of the academic staff needed to teach these students grew at less than one third of the rate of increase in student enrolments (DOE 2004b).

The use of educational technology could help the higher education institutions to meet the increasing demands of large enrolments of students and high learning volumes. The response to this crisis is to analyse the results from the previous chapter to ascertain whether the utilisation of electronic formative assessment in the large, 24/7, high-

maintenance and complex IT environments created by the higher education institutions can be used to improve assessment and learning.

This study tested the following hypotheses:
Hypothesis 1: The learner achievements of those learners who have used a computer before attending campus are much higher than those learners who have not.

Hypothesis 2: The learner achievements of those learners who received treatment in the experimental group are much higher than the control group who did not receive treatment.

5.2 SUMMARY OF RESEARCH FINDINGS

Hypothesis One: The first hypothesis cannot be rejected. Anova of the test scores further revealed that learners who had access to a computer prior to attending the technikon had higher results than those who had no prior usage. The only exception were the coloured female learners who had no prior computer usage, and who showed equal or better results than learners who have had prior computer usage for the practical Test 1 File Management. This suggests the existence of a digital divide.

Hypothesis Two: The second hypothesis in this study can be rejected. Anova has revealed no significant differences between the experimental and control groups in Test 1 File Management. This suggests that the electronic formative assessment used on the experimental group was not very effective in improving learning achievement. In Test 2 Theory, there was a significant difference between the control and experimental groups. The control group performed better than the experimental group. The control group had instructional-based formative assessment, whereas the experimental group had electronic formative assessment. This could be attributed to 78 % of the learners had English as a second language (ESL). The experimental group had to read and comprehend from the computer screen. Figure 1 (Annexure VII) on the means of the major languages, shows that the results for the theory test for ESL learners were poor.

Evidence from the literature has also shown that the predominance of English in online content may limit widespread interest in and use of the Internet among non-English speaking populations and the high levels of illiteracy amongst the disadvantaged communities are probably a greater hindrance (Bridges.org 2003).

Gender

A Kruskal-Wallis test was conducted to evaluate differences between genders in the file management and theory test. The tests showed that there were no significant differences between genders. This is in accordance with the evidence from the literature, which showed that no differences were evident between female and male learners that had been using a computer as a tool and for communication at higher education institutions (Stephens 2001; McCoy & Heafner 2004).

Race

A Kruskal-Wallis test was conducted to evaluate differences between races in the file management and theory test. The test showed that there were significant differences between black female learners and coloured female learners. The coloured female learners' achievements were much higher than those of the black female learners. Literature has revealed that on the one hand, that coloureds had 34 % access to computers, and 39% can use computers, and, on the other hand, that blacks had 19% access to computers and 16% can use computers (Saner 2003).

5.3 RESEARCH OBJECTIVES

The first research objective was to provide insight into the technological and language background of first-year learners and the digital divide.

Learners' previous experience and prior learning (or lack of it) all impact directly on their learning (Czerniewicz 2004). This was clearly evident in the findings when comparing learners' use of technology and the scores from the File Management test.

The results of the analysis of the connection between the technological background and scores of Test 1 File Management, revealed that black learners who had used a photocopier, ATM, fax machine and printer showed higher scores. Results also revealed that female learners, who had used this technology, showed higher scores in the test. Coloured male learners showed no difference in their test scores whether they had made use of technology or not.

Seventy-eight percent of the respondents had English as a second language and this was clearly revealed in the results of the theory tests in all statistical analyses. The results of the theory tests, which required reading and comprehension, seemed to be a problem for ESL learners. In the theory test, the learners whose home languages were Afrikaans and IsiXhosa, performed poorly. However, in the practical test learners who had Afrikaans as a home language, were identical to learners whose home language was English. Initiatives are starting to emerge in South Africa that will foster the development of local language content in electronic formats, especially in the educational technology area (Bridges.org 2003).

Thirty-two percent of the respondents in the Western Cape reporting about Internet usage are between the ages of 18-24, 76% speak English, 58% are male, 61% are white and 33% are coloured, 23% have a monthly household income of over R30 000 and 59% have a university or tertiary qualification (Bridges.org 2003). Sixty-nine percent of the respondents reported access to a computer for personal or school use prior to attending the technikon, 20% owned a computer, 3.8% had access to the Internet and 60% owned a cell phone. Comparison of the statistics for the Western Cape and the respondents reveals there is a discrepancy in the access and usage of the computer. A higher percentage of learners have access to a computer in comparison to the percentage of Western Cape respondents access to a computer. The research objectives of the study will be discussed below:

1. Examine the efficacy of online learning

Online learning gets very positive feedback from the learners. The results of the questionnaire clearly revealed that online learning had significantly improved their learning. The online learning issues for concern were technical support, language difficulty and the comprehension of instructions. Learners found the assessment relatively easy, and two thirds preferred doing other subjects online.

2. Empirically determine the effect of a constructivist, technology-rich learning environment, specifically the use of electronic formative assessments, on learner achievement

It was hypothesised that the learner achievements of those learners who received treatment in the experimental group would be much higher than the control group who did not receive treatment. The File Management test results of the Kruskal-Wallis test did not find a significant difference between the experimental and control groups. The theory test results of the Kruskal-Wallis test nullified the hypothesis, as the control group achieved higher achievement than the experimental group.

These findings were in direct contradiction to studies that have found that electronic formative assessment has improved summative scores (Stephens et al. 1998; Bull & Stephens 1999; O'Reilly & Patterson 1999; Buchanan 2000; McKenna & Hesketh 2000; Khan 2001; Ricketts & Wilks 2002; Aster 2003; McCabe & Skinner 2003; Roodt & Conradie 2003).

5.4 RECOMMENDATIONS FOR FURTHER RESEARCH

Given the significant findings concerning achievement gains made by coloured female learners who had no prior knowledge of computer usage, a detailed study including qualitative research could be recommended to validate the reported findings further.

5.5 CONCLUSION

Higher education exists in a dynamic environment where change is normative. When considering the higher education environment, we have to consider this from two angles. The first is the strategy to develop learners who are academically, socially and technologically competent. Secondly, standards in accordance to the National Qualifications framework have to be maintained. Institutions need to reassess their strategy and constantly align and re-align their learning programmes to that strategy.

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APPENDIX I

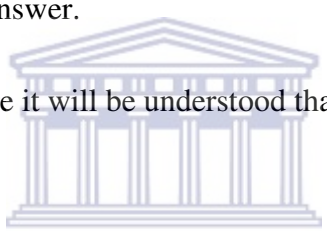
Dear Student

I am inviting your participation in a study, which forms part of my research for my Masters in Information Management at the University of the Western Cape.

This study will be used to evaluate the technological background and online learning experiences amongst students and how this affects their progress in Business Information Systems.

The questionnaire will take you 30 minutes to complete. It consists of 5 pages with a total of 24 questions. The majority of questions is multiple-choice format and asks you to select the most appropriate answer.

By completing the questionnaire it will be understood that you have consented to participate in the study.



The information that you supply will remain confidential. The results of the study will be used as part of my thesis, but you may be assured that any information obtained in connection with this study that may be identified with you, will remain confidential and will not be disclosed.

I thank you for your participation and help to re-look at teaching and learning methodology in the future.

Sincerely

Paliga Pillay

APPENDIX II

STUDENT NUMBER ☐

INSTRUCTIONS

Answer the questions by (use tab key):

- Choosing the most suitable option from the drop down list.
- Typing in your response in the space (field) provided, or
- Clicking on a checkbox (an X will be inserted e.g. ☐).

DEMOGRAPHICAL DATA

1. Race group If Other (please list) Black, Coloured, White, Indian, Other
2. Age 17 – 19 yrs; 20 – 22 yrs; 23 – 25 yrs; 26 + yrs
3. Gender Male; Female
4. Home language If Other (please list) English; Afrikaans; IsiXhosa; IsiZulu; Is Ndebele; SiSwati, Zitona, Sesotho, Setswana, Sepedi, Tshivenda
5. Type of school attended If Other (please list) Private, Public School, Model C School, Farm School, Village School

TECHNOLOGICAL BACKGROUND

6. Does your household own

TELEPHONE	TELEVISION	RADIO	COMPUTER
☐	☐	☐	☐

7. Do you own a cell phone?

Yes No

8. If "Yes" to the use of a Cell Phone, did you use a cell phone to

Receive calls	Make calls	Send SMS	Games
☐	☐	☐	☐

9. If "Yes" to own a cell phone, who is your cell phone provider?

Vodacom	MTN	Cell C
☐	☐	☐

10. Have you made use of the following equipment?

Telephone		Printer		Fax Machine		Photocopier		Computer		ATM		Cell Phone		Internet	
Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

11. If "Yes" to the use of ATM, what was your feeling when you first used the ATM?

CONFIDENCE	FEAR	UNCERTAINTY
☐	☐	☐

IF THE ANSWER IS "YES" TO USING A COMPUTER, ANSWER QUESTIONS 12 AND 13 IF THE ANSWER IS "NO" ,GO TO QUESTION 14

12. Where did you have access to a computer?

Work; library; School; College; Internet Café; Friend; Family; Community Centre; Other

13. Have you ever used an Email programme to send or reply to correspondence?

Yes No

ONLINE EXPERIENCE

14. How would you rate your ability with using a computer since coming to Pentech?

POOR	AVERAGE	GOOD	EXCELLENT
☐	☐	☐	☐

15. Which of the following computer applications software do you find useful?

WORDPROCESSING	SPREADSHEETS	DATABASE	INTERNET EXPLORER
☐	☐	☐	☐

16. Do you find using the Skills Vantage Manager (SVM) programme

VERY DIFFICULT	DIFFICULT	EASY	VERY EASY
☐	☐	☐	☐

17. Has the SVM programme assisted you in learning?

YES	NO
☐	☐

18. What was most difficult about the programme?

Other (please list)

Language, Font size, instructions, No difficulties

19. Which PART of SVM did you find most useful?

PART 3 (Word)	PART 4 (Excel)	PART 5 (Access)	PART 7 (Internet)	NONE
☐	☐	☐	☐	☐

20. How did you find the POST ASSESSMENTS on SVM?

VERY DIFFICULT	DIFFICULT	EASY	VERY EASY
☐	☐	☐	☐

21. Would you prefer to use a programme like SVM for other subjects in Higher Certificate in Accounting (HCA)?

22. If

YES	NO
☐	☐

"Yes" to the previous question, do you prefer to do your ASSESSMENTS for these subjects on the computer?

YES	NO
☐	☐

23. Do you think computer skills are necessary in today's world?

YES	NO
☐	☐

24. Do you use the library computer system to search for a book?

YES	NO
☐	☐

THANK YOU

APPENDIX III

BUSINESS INFORMATION SYSTEMS MODULE 1

Business Information Systems Module 1 is a half course that gives a practical introduction to modern computer systems. This course develops familiarity with modern computer systems and encourages their productive use. Module 1 introduces concepts and discusses computer software and hardware systems then considers a range of computer applications, social, legal and ethical issues. The taught course is supplemented by on-line demonstrations and practical exercises. The Course is split into 4 Units that has to be completed in the First Semester.

	TYPE OF LEARNING	***NOTIONAL HOURS***	***CREDITS***	***WEEKS***
		70	***7***	***9***
Unit 1a	***Theory***	***15***	***1.5***	***2***
Unit 1b	***File Management***	***20***	***2***	***2***
Unit 1c	***Word Processing***	***25***	***2.5***	***3***
Unit 1d	***Internet & e-mail***	***10***	***1***	***2***

APPENDIX IV

WEEKLY PROGRAMME

WEEK NO.	*WEEK BEGINNING*	*DETAILS*	*Contact time/wk*	*Add time/wk*
5	30 January 2004	File Management	3 hours	2 hours
6	6 February 2004	File Management		
7	13 February 2004	File Management		
8	20 February 2004	File Management		
9	27 February 2004	Internet and e-mail		
10	5 March 2004	Internet and e-mail		
11	12 March 2004	Word processing		
12	19 March 2004	Word processing		
13	26 March 2004	Word processing		
14	2 April 2004	Test week		
15	9 April 2004	VACATION		
16	16 April 2004	Word processing	3 hours	2 hours
17	23 April 2004	Word processing		
18	30 April 2004	Theory		
19	7 May 2004	Theory		
20	14 May 2004	Spreadsheet		
21	21 May 2004	Spreadsheet		
22	28 May 2004	Spreadsheet		
23	4 June 2004	Test Week		
24	11 June 2004	Test Week		
25	18 June 2004	Test Week		
26	25 June 2004	TEST WEEK		

APPENDIX V

ASSESSMENT SCHEDULE

TYPE	ASSESSMENT	WEIGHT	DATE
File Management	Test 1 (M)	10%	Test week
Internet & Email	Assignment	15%	1 March
Word Processing	Project	15%	13 April
Theory	Test 2	20%	9 May
Practical/Attendance	Tutorials/Participation	10%	16 May
	Portfolio	5%	31 May
	Attendance	5%	31 May
Integrated	Test 3	20%	Test week

APPENDIX VI

CURRICULUM

UNIT	SPECIFIC OUTCOMES	ASSESSMENT CRITERIA
1a	Describe the basic hardware elements and software of a computer.	♦ The motherboard and major components that can latch on, can be described and identified. ♦ The function of the input and output devices of a computer can be explained. ♦ The operations of the input, possessing, storage and output can be explained. ♦ The memory and storage devices can be explained. ♦ The benefits and topologies of networks can be explained. ♦ The computer as a research and communications device can be explained. ♦ Copyright implications can be explained. ♦ Good housekeeping principles for computers can be explained. ♦ The selection and purchasing of software can be explained. ♦ The selection and purchasing of hardware can be explained. ♦ An e-commerce trade cycle can be described.
1b	Use operating systems and utility software to perform computer storage management functions.	♦ The function of operating and utility software can be explained. ♦ The concept of a computer file can be explained. ♦ Computer file storage can be manipulated.

APPENDIX VII

LANGUAGE AND TECHNOLOGICAL BACKGROUND (TABLES AND GRAPHS)

Language

Table 1 Descriptive statistics for the major languages

Group	Count	Mean	Standard Deviation
File Management Test			
Afrikaans	39	75.13	21.26
English	21	75.24	18.87
IsiXhosa	102	51.37	27.86
Theory Test			
Afrikaans	39	46	14.51
English	21	56	16.14
IsiXhosa	102	39	12.84

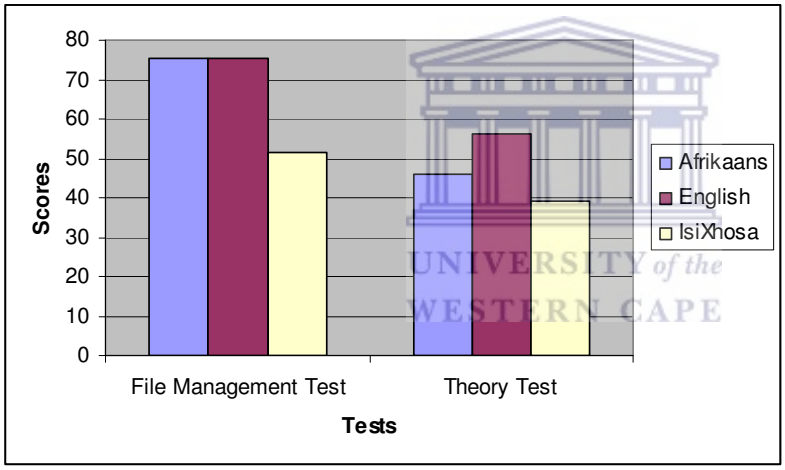


Figure 1 Means **to compare languages of File Management and Theory**

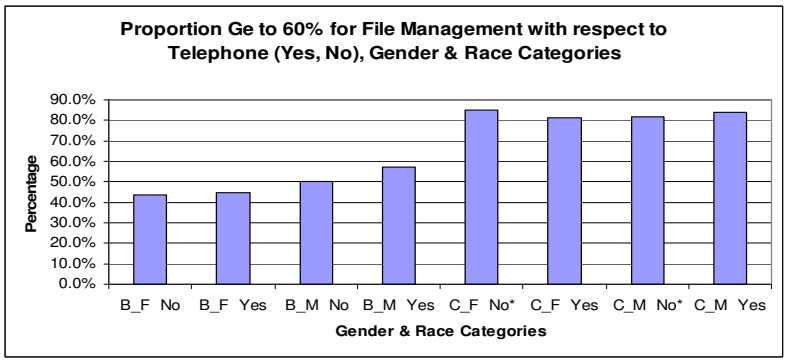


Figure 2 Means **to compare Telephone ownership and File Management results**

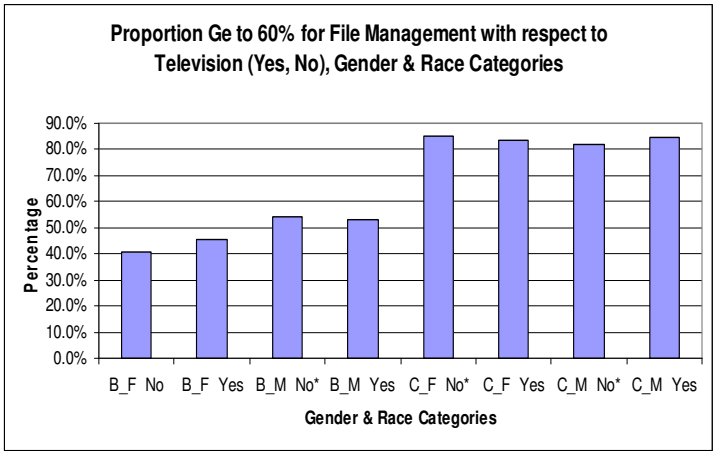


Figure 3 Means **to compare ownership and File Management results**

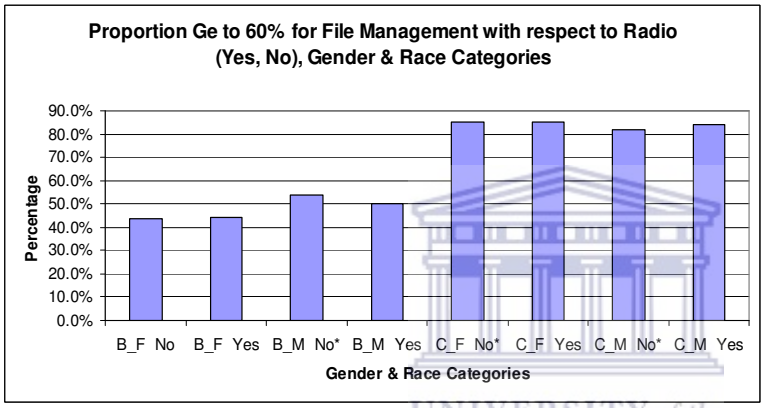


Figure 4 Means **to compare Radio ownership and File Management results**

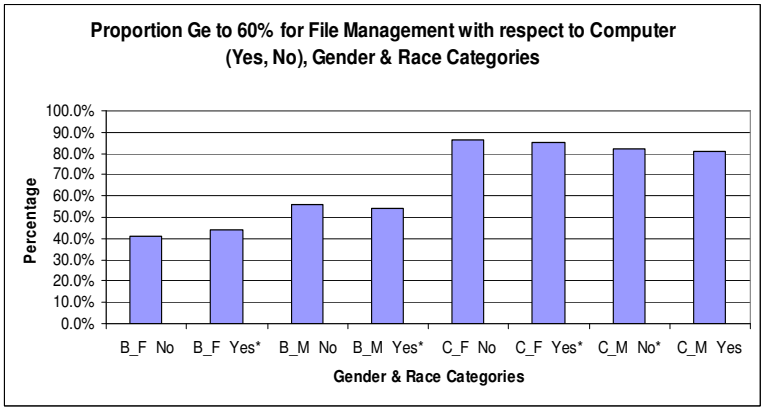


Figure 5 Means **to compare computer ownership and File Management results**

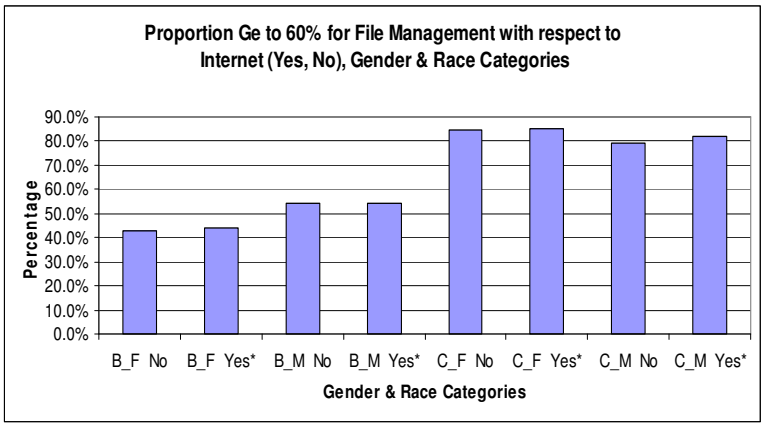


Figure 6 Means **to compare computer ownership and File Management results**

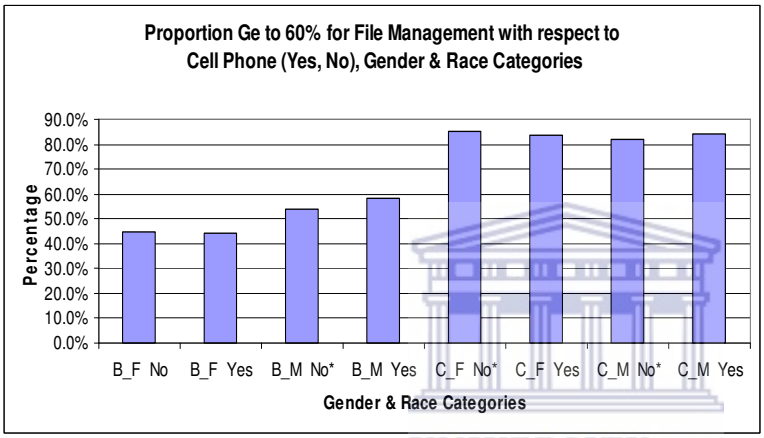


Figure 7 Means **to compare computer ownership and File Management results**

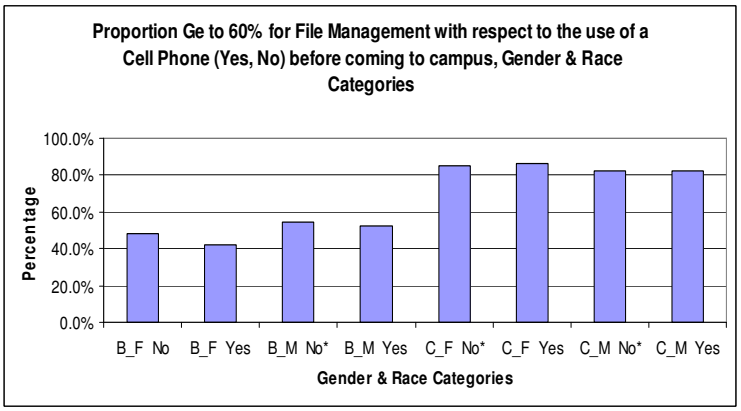


Figure 8 Means **to compare cell phone and File Management results**

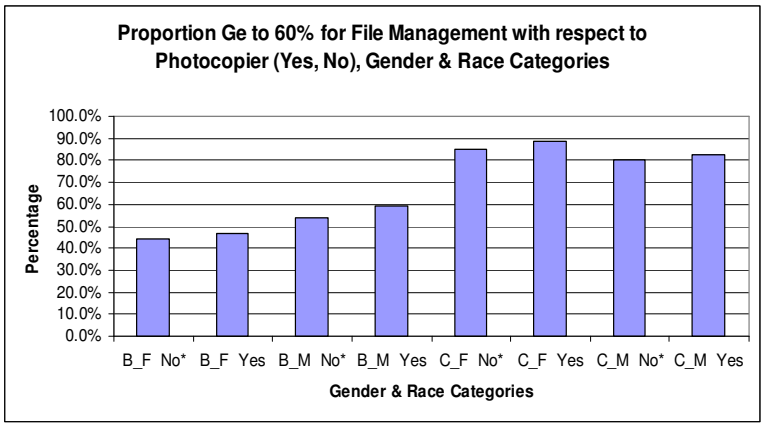


Figure 9 Means **to compare photocopier and File Management results**

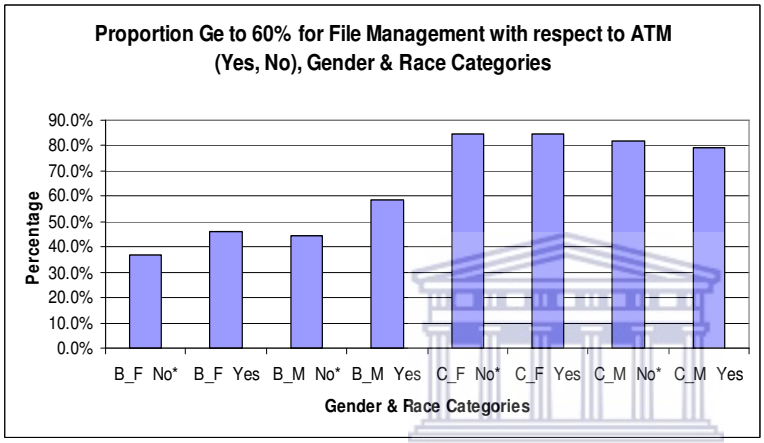


Figure 10 Means **to compare ATM and File Management results**

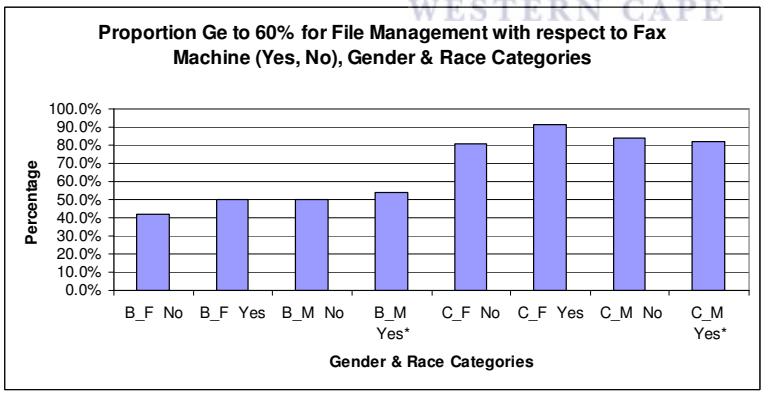


Figure 11 Means **to compare fax machine and File Management results**

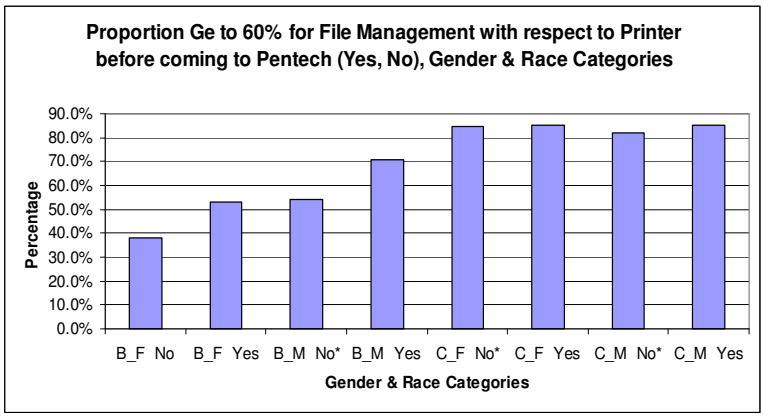


Figure 12 Means **to compare printer and File Management results**

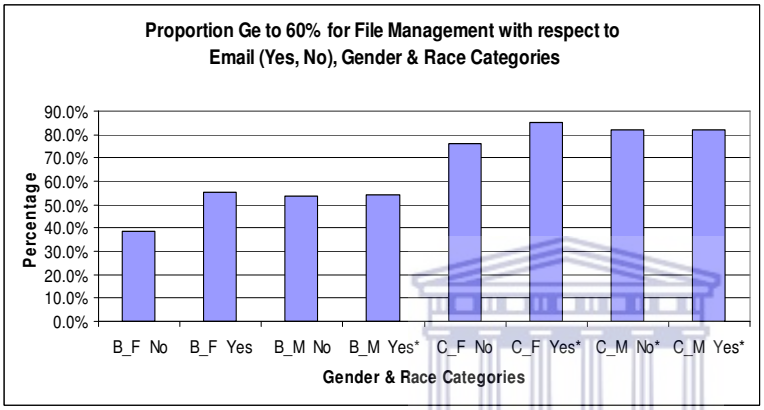


Figure 13 Means **to compare email and File Management results**

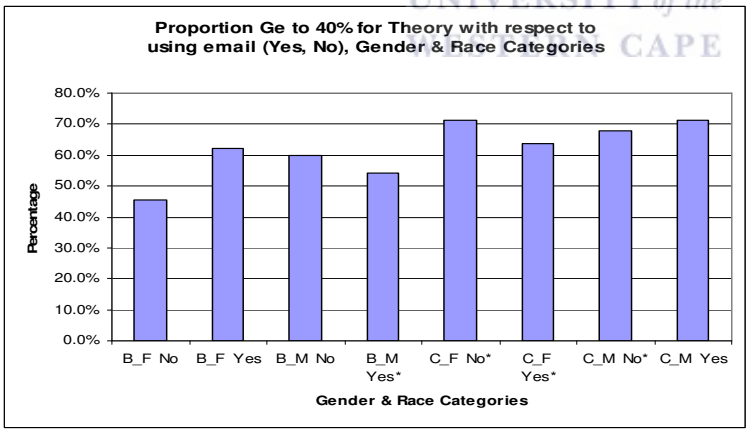


Figure 14 Means **to compare email and Theory results**

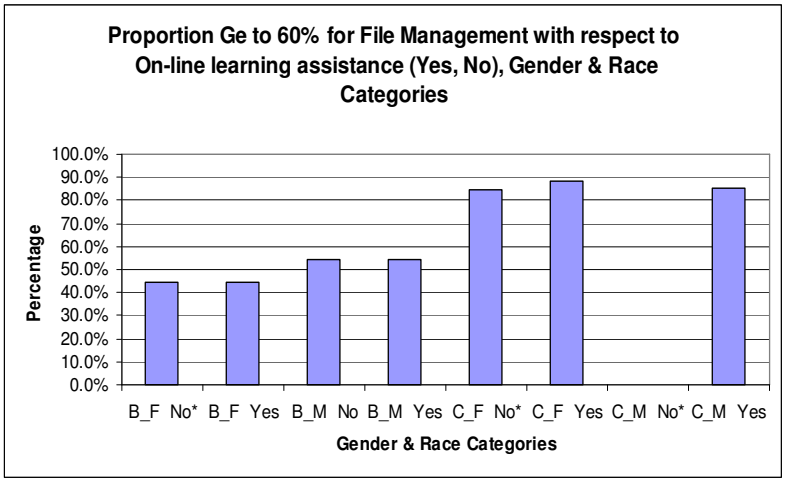


Figure 15 Means **to compare On-line assistance and File Management results**

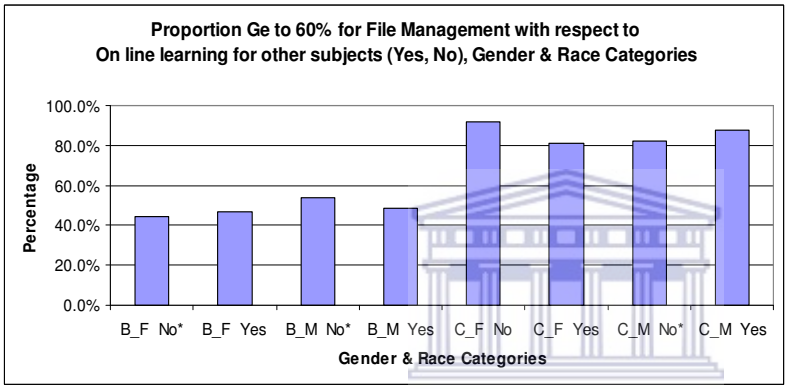


Figure 16 Means **to compare online learning for other subjects and File management results**

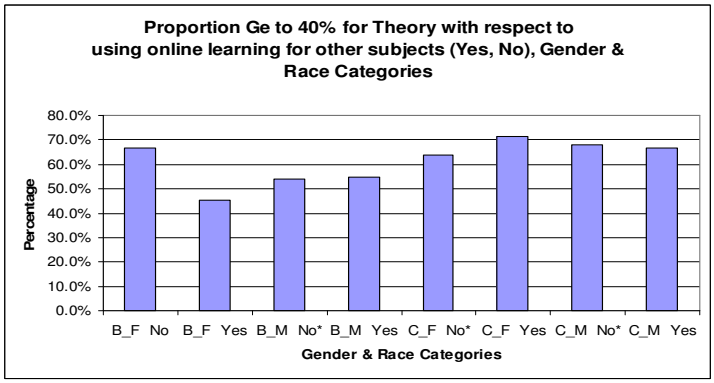


Figure 17 Means **to compare online learning for other subjects and Theory results**

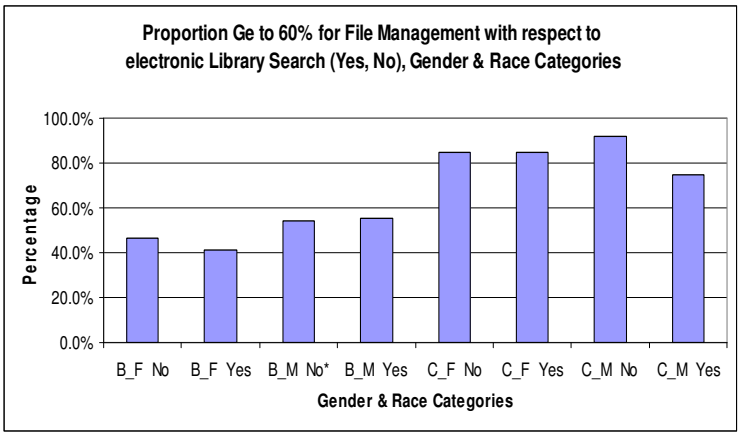


Figure 18 Means **to compare electronic library search and File Management results**

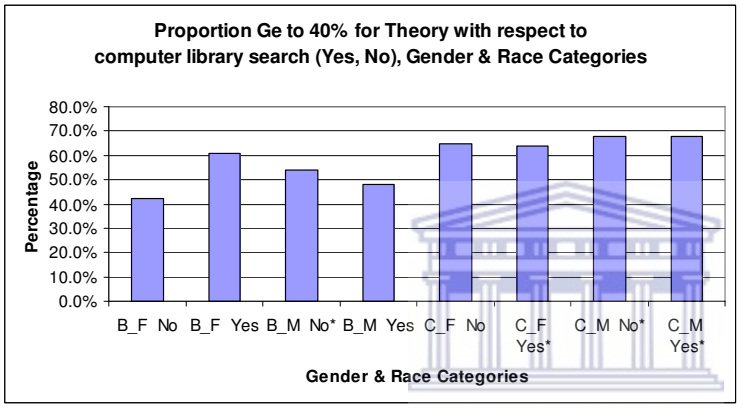


Figure 19 Means **to compare electronic library search and Theory results**