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Barriers as experienced by WITS first year B Ed students when accessing computers and ICTs (Information and Communication Technologies).

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Masters Research Project

Barriers as experienced by WITS first year B Ed students when accessing computers and ICTs (Information and Communication Technologies).

Research report submitted to the School of Education,
Faculty of the Humanities,
University of the Witwatersrand, Johannesburg,
in partial fulfillment of the requirements
for the degree of Masters in Education

Johannesburg, December 2009

Abstract:

In this study the possible barriers / obstacles to or use of ICTs that first year B Ed students on the Wits School of Education campus are explored. Through the means of a questionnaire requiring both quantitative and qualitative responses the students' comments are analysed for possible trends. The issue of age being a possible barrier is evaluated in light of the literature and data provided. As two groups of students, a young pre-service group and an older in-service group, emerge, the differences and similarities in their Information and Communications Technology (ICT) experience on campus is detailed. Conclusions are drawn as to what barriers each of these groups of students face and recommendations are proposed as to how these students can be assisted to overcome these hurdles in order to promote a more effective ICT experience.

Declaration:

I declare that this research report is my own unaided work. It is submitted for the degree of Masters in Education at the University of the Witwatersrand, in Johannesburg. It has not been submitted before for any degree or examination at any other university.

Claudette Ann Muller _____

Name of candidate Signature of candidate

4th day of June, 2010

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My mother for being my support, reader and editor of many pages.

My faithful old laptop which has now slowed down to the extent that it will be rewarded with early retirement to a world of Disney, JumpStart and other educational pc games.

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Abbreviations:

WSOE	Wits School of Education
ICT	Information and Communication Technology
B Ed	Bachelor of Education
GOL	Gauteng-On-Line
WCED	Western Cape Education Department
CoP	Community of Practice
Df	Degrees of freedom

Chapter 1: Scope of the Research

1.1. Introduction:

Why do old people hate computers and young people love them?[1]

Do older students find it more difficult to use computers than younger students and what are these terms "digital native' and digital immigrant" that are currently being bandied around? Surely, all students should be able to access a computer and use it effectively regardless of their age. This study delves into these issues in more detail. An in-depth review of the current literature has been made in addition to a study of the current group[2] of first year B Ed students on the Wits School of Education (WSOE) campus as to whether there is any truth to the above statement.

1.2. Background:

I, the researcher, coordinate the presentation of a six month basic Computer Literacy course to all first year B Ed[3] students. When the Wits School of Education (WSOE) registered a first year group comprising of pre-service[4] students as well as in-service[5] Limpopo students, I realized that this was a unique opportunity to study two very diverse student groups. Never before had WSOE enrolled such a large group of students (approx 800 students) who were so clearly divided into two groups along the lines of age. Historically, the first year intake numbers had not exceeded 400 students and as a result logistical issues with regards the physical accessing of computers on the WSOE campus were anticipated. In addition to a large group of pre-service students entering the university after recently completing their matric / grade 12 year, an additional 215 students

[1] A question posed on www.answerbag.com/q_view/144395
[2] 2009
[3] Full time Four year Bachelor of Education degree
[4] First year students starting their first professional degree. These students are not qualified teachers.
[5] Students who are already qualified teachers who have returned to study further.

who are currently practicing Foundation Phase[6] teachers were awarded bursaries for their studies while on full pay in a Limpopo Education Department initiative to 're-skill' their teachers. This was done in an attempt to improve the future standard of education in the Foundation Phase in the Limpopo province (City Press 1 February 2009) See attached Appendix B. As a result, with such a mix of students, it became evident that their ICT skills varied considerably which presented a pedagogical challenge. It is assumed that a fair number of the first year pre-service students have had considerable access to ICTs and have completed courses such as the ICDL[7] in their secondary / high schools. For others, as will become evident later in this study, this year at WSOE is the first time they were exposed to ICTs. There is a wide discrepancy of computer literacy skills and the possible reasons for this makes for an interesting study.

At present[8] there is one open access[9] computer lab with temperamental printing and Internet facilities on the WSOE campus. This computer lab has 29 computers and at the time of writing all of these computers were fully operational. Six computers are available in the WSOE library. One of these is currently not operational. These computers have printing facilities and Internet access. Another six computers without Internet access are available in the Graduate Reading room in the Library. Other computer teaching labs exist on campus but these are restricted to use during teaching times and cannot be left open due to security issues. A new 100 seater open access computer lab is in the process of being built and this will help alleviate the desperate need for ICT facilities on campus.

[6] Grade 1 - 3
[7] International Computer Driver's License
[8] November 2009
[9] Computer lab is open 24 hours seven days a week.

1.3. Research Problem:

What barriers, if any, are experienced by WITS first year B Ed students when accessing computers and ICTs (Information and Communication Technologies) on the Wits School of Education campus.

In the sphere of this study, barriers are seen to be obstacles hindering a student's experience with or of computers / ICTs on campus - one or more phenomena that impact negatively on a student's usage of ICTs. The origination or reason for the existence of these real or perceived barriers is complex. In addition, the full extent to which these barriers impact on the student's ultimate experience with ICTs warrants further research that the scope of this study does not provide for.

The older in-service students may not have had the same access to and experience with ICTs as the younger recently matriculated pre-service students. This alone may prove to be a barrier in the older students' current usage of ICTs on the WSOE campus. For this reason I anticipate that the age of the older in-service group of students may be one of barriers experienced to the effective use of ICTs on campus. However age alone cannot be seen to constrain a student's interaction with ICTs. For this reason, this study aims to evaluate other possible barriers, identified both in the literature and by the research participants, and initiate discussion as to how they ultimately co-impact on the student's ICT usage.

Research Questions:

This research is concerned with how barriers, if any, identified by first year B Ed students may impact on their ability to use and access ICTs effectively.

Some relevant secondary questions include:

- Is there a clear division in the group of first year B Ed students along the lines of age with regards their ICT usage on the WSOE campus?
- Do first year B Ed students face any barriers when accessing ICTs on the WSOE campus?

- If such barriers are experienced, what are these barriers?
- Does the younger group of pre-service students experience, if any, the same barriers as the older in-service group of students?
- Is there a difference in how the younger group of pre-service experience ICTs, i.e. either positively or negatively, when compared to the older in-service group of students?
- Does either group of students indicate that language is a barrier in their use of ICTs?
- Is there a realization of the importance / value of the use of ICTs in the students future teaching careers?
- To what extent can the older in-service group of students be considered novice ICT users?

1.4. Rationale:

Professor Loyiso Nongxa, the Vice Chancellor and Principal of the University of the Witwatersrand, states on the official website of the City of Johannesburg[10] that the university continues to attract the best students irrespective of socio-economic background. Two major transformation projects ensure that students from the rural areas are enrolled at Wits as well as to increase the number of African female students in Science and Engineering. Therefore students studying at WITS should not be disadvantaged by their previous lack of exposure to ICTs, their gender, race or even locality. Endeavors should be made to minimize the gap between those who have been excluded for various reasons in the past and those who have not.

This research has the potential to highlight in primary academic terms rather than technological ones, the urgency for more ICT facilities on the WSOE campus. Comparisons between the perceived barriers that the younger group of pre-service first year B Ed students and the older

[10] http://www.joburg.org.za/content/view/2017/199/

group of in-service students from the Limpopo province of South Africa have been drawn. From these findings assumptions regarding the different ways the two groups of students' access computers / ICTs could be made. As a result conclusions could be drawn and recommendations made as to how to minimize these barriers and better assist the students with their ICT usage.

By asking the students to describe their previous and current experience with ICTs as well as which computer programme applications they would like to become more skilled in using, the first year Computer Literacy course presenter's teaching and course development would be better informed.

1.5. Preliminary findings:

Aside from the hardships of being away from their families, staying in a residence, *Stay City*[11], a distance from the university campus and relying on bus transport to get to the WSOE campus, these are mature students – many of whom are accessing ICTs for the first time.

The larger group of younger students are typically entering their B Ed degree straight from completing their matric (grade 12) at a high / secondary school (38% matriculated last year, 2008, 18% in 2007). These students did not seem to have the same issues of access as the older group when it became apparent that the two groups experience the use of ICTs in very diverse ways. Due to the large age discrepancy I was drawn to the research possibility of whether a student's age may act as a barrier in their access to ICTs. If this barrier does indeed exist, it would be interesting to establish to what extent is it experienced by the first year B Ed students, in particular, the older in-service Limpopo group of students.

[11] Off campus residence or boarding house. www.staycity.co.za

1.6. Clarification of terminology:

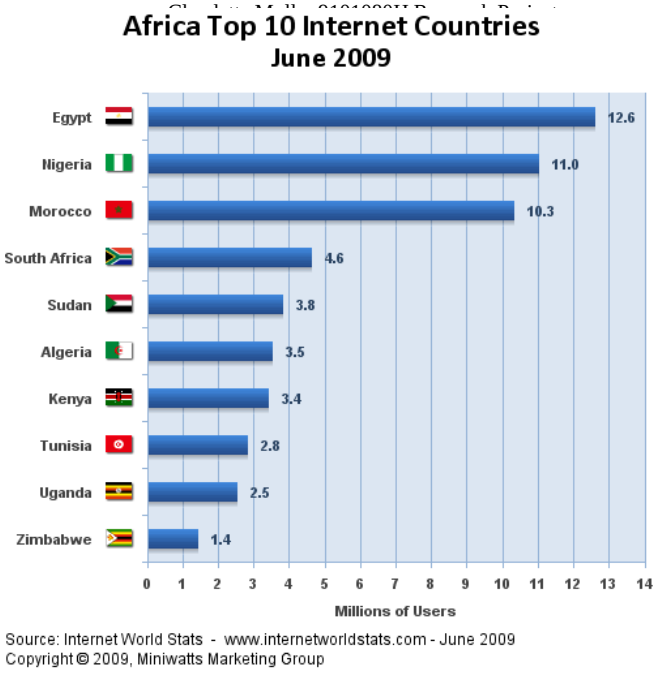
Throughout this study, the terms *computers* and *Information and Communication Technologies - ICTs* are used interchangeably. To avoid repetition of words and also to locate the study within current debates in the field, the term ICTs is favoured. This term is an umbrella term that incorporates any communication device or application, as well as connecting to the Internet. According to Dan Russell[12], director of the User Sciences and Experience Group at IBM's Almaden Research Center, by 2010 computing will have become so naturalized within the environment that people will not even realize that they are using computers. This trend is referred to as pervasive or ubiquitous computing, a trend being brought about by a convergence of advanced electronic - and particularly, wireless - technologies and the Internet. The term *computer* is very specifically defined as the actual computer machine and is used in this study in this context.

It may be useful here to clarify what is meant by 'access' to ICTs. Obviously access entails having just that, physical access, to ICTs, such as functional suitable computers. However more is entailed than mere physical access, as it also implies that the user, in this case the student, also be able to effectively navigate their way through the relevant Operating System and complete relevant tasks, such as the typing of assignments and searching for information on the Internet (two tasks mentioned in students' responses on the questionnaire).

It may be useful here to locate where South Africa is in relation to the rest of Africa in particular in its internet usage.

[12] http://searchnetworking.techtarget.com/sDefinition/0,,sid7_gci759337,00.html

[13]



The above table shows that South Africa is the fourth top Internet Country in Africa with 4.6 million Internet users. Statistics are available[14] showing that South Africans comprise 6.8% of the Internet users in Africa with a population penetration of only 9.4%. Less than one in 10 South Africans has access to the Internet. While this may appear low when compared to other African countries such as Egypt, 18.7%, it is interesting to note that in the last nine years there has been a user growth of 91.3%. The population penetration is expected to reach 20% by the year 2013. Is this proliferation of Internet use resulting in narrowing the so called 'digital divide' in South Africa? While more people will be accessing the Internet, this physical access alone does not ensure that the technology will be put to effective use.

[13] www.internetworldstats.com
[14] www.internetworldstats.com

Chapter 2: A Review of the Literature

2.1. Introduction:

"No one is not computer literate these days." A broad sweeping statement made by a 33 year old pre-service first year B Ed student.

What is 'computer literacy'? Is it a necessity in 2009? Many possible definitions exist and a precise definition that focuses on ability and skills without ignoring understanding is hard to find. Computer Literacy is a purposefully vague term coined by Andrew Molnar in 1972 while he was the director of the Office of Computing Activities at the United States National Science Foundation. Defined as the *"basic skill in the use of computers, from the perspective of such skill being a necessary societal skill"* (Aspray, 1991). This assertion that it is a necessary societal skill is quite forward thinking if one considers today's technological world which involves the much needed societal collaborative tools such as communicating via e-mail, using social networking tools such as wikis, blogs etc. Delving further into the first part of definition – "*basic skill in the use of computers*" Molnar suggests that this 'basic skill' implies understanding of the concepts, terminology and operations that relate to general computer use. It is the essential knowledge needed to function **independently** with ICTs. This includes being able to solve problems, adapt to new situations, keep information organized and communicate effectively with other computer literate people.[15] This ability to work independently is vital to developing some form of computer or digital literacy which implies a certain degree of comfort using a computer and its associated programs. A community of practice of computer literate people is implied here. This is further supported by Menchaca (1997) who indicates that creating access to technology means more than just providing hardware, software and Internet connections. Providing equitable access includes considering cultural and skill differences in designing

[15] www.virtualbill.net/qamain.html

interfaces and providing comfortable environments in which people can realize their own potential

Generally "literate" (in the realm of books) connotes one who can read any arbitrary book in their native language, looking up new words as they are exposed to them. Likewise, an experienced computer user may consider the ability to self-teach (i.e. to learn arbitrary new programs or tasks as they are encountered) to be central to computer literacy.

Computer Literacy involves a user being able to **adapt** and **learn new** procedures through various means while using ICTs and as a result computer education should not be rote memorization. Students should not be taught how to perform several specific common functions (e.g. open a file, save a file) in a very specific way, using one specific version of one specific program. As when faced with a different program or a different version of the same program they are confused or frightened by the differences from what they have learned. These students rely on paper notes for some computing tasks and need tremendous amounts of hand holding.

This study examines whether students are hindered from achieving a certain degree of Computer Literacy, - understood in the scope of this study as being the ability to function independently with ICTs. If any such barriers or obstacles are faced, what are they? Juxtaposing this is the investigation into whether there are any aspects that make it 'easier' to use ICTs and therefore achieve a higher degree of Computer Literacy. In addition to the above this study hopes to explore whether such barriers are experienced differently by the two groups of students – namely the younger group of pre-service students and the older group of in-service Limpopo students.

2.2. Identification of possible barriers:

The E-Divide team (2006), identified barriers in people's access to ICTs in their ThinkQuest[16] website[17] as being physical, digital, human and socioeconomic.

Physical barriers, quite simply defined, are a lack of access to the actual computer hardware and the Internet. A person is obviously unable to learn to use ICTs and relevant applications if he / she does not have access to one. The e-Divide Team (2006), state that individuals who do not have access to physical resources are generally those who come from lower socio-economic brackets. They go on to add that the determining factors of who has access and what the quality of that access is, are race, gender, linguistic capability, cultural heritage and income. Tied closely to physical barriers are **digital barriers**. Such barriers include a lack of access to relevant and useful software and a lack of access to online content in an understandable format, language and cultural relevance. Inability to utilize the Internet in order to connect with other students / people from different regions, cultures and socioeconomic statuses is also identified as a digital barrier. As the focus in current debates moves from material or physical access to the skills and opportunities that a person has to possess in order to be able to use ICTs, it is apparent that just having access does not guarantee the ability to use or make use of the technology, in this instance, ICTs. Gudmundsdottir (2005) elaborates on this by analogizing that by having access to books does not mean that you will be able to read them, let alone use their content to your own benefit.

Human barriers highlight the lack of human resources, such as experienced and trained facilitators who would be able to help the students develop an adequate knowledge and necessary

[16] ThinkQuest inspires students to think, connect, create, and share. Students work in teams to build innovative and educational websites to share with the world. Along the way, they learn research, writing, teamwork, and technology skills

[17] This website is available at http://library.thinkquest.org/05aug/00036/en/text/index.html

skills in the use of ICTs. Schools in a low socio-economic bracket are often unable to attract well-qualified, digitally literate teachers.

An underlying mechanism is one of **socio-economics**. Students in a low socioeconomic group may experience a lack of resources which can include maintenance, use, effectiveness etc. In my experience students have indicated that the resources may be present, even in schools that fall into a low socioeconomic bracket. The problem is that these computers are locked away in the computer lab and teachers and students are not allowed to utilize them for fear that they might "break" them. This may be evidence of a lack of acknowledgement of technology's growing importance, as well as a lack of acceptance of technology as seen by the E-Divide team in lower socio-economic groups.

There is a wide variety of literature available in the area of the socio-economic, human, digital and physical barriers that students face when accessing ICTs. As a result of these barriers, there is a divide that exists between the 'haves' and the 'have nots'.

2.3. "Divides" identified in the literature:

The Digital Divide is a key term that consistently arises throughout the literature. It came into regular use in the mid 1990s and is described as the "gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and their use of the Internet for a wide range of activities" (OECD, 2001).

Although this description is neutral, a lot of emphasis is placed on physical access. It is thought that the main reason a troubling gap exists between the 'haves' and the 'have nots' is a socioeconomic one. However it appears that there is not only inequality in gaining access to a computer terminal (hardware), but also inequality in the person's ability to use the technology

effectively and fully. The mere presence of ICTs does not guarantee that they will be used. Some of the first year B Ed students report of fully stocked, up and running ICT labs which are locked by the school principal, not to be used for fear of the teachers and learners breaking them and the absence of an instructor (human barrier). It becomes evident that the division between students successfully using ICTs and those who do not / cannot is a complex one and arguably many other factors come into play.

So while the Digital Divide is a complex concept that is currently being bandied about in the literature, the stance / focus that I take is that two distinct groups of students exist; the digital natives and the digital immigrants (Prensky, 2001) and there is a dichotomy between the two. Student responses specific to each group are available and this study hopes to compare the responses of both groups and draw some conclusions as to whether the students do in fact face barriers / obstacles when accessing ICTs on campus and what exactly these are. The gap between those empowered by technology and those who have been excluded must not widen as the only thing that needs to be broadened is the thinking of those who believe technology is for the privileged few (Martindale, 2002). In support of the above statement, it is important that any possible barriers that the first year students face are identified and ultimately minimized.

The digital divide has long been explained from the standpoint of having material or physical access to computers and the Internet. Despite statistically improved access to ICTs in most places of the world, the emphasis has, in recent years, moved to other factors which also seem to have significant influence on the digital divide (Gudmundsdottir, 2008). While it is generally accepted that such a divide does exist Castells (1999), in his discussion paper for the United Nations Research Institute for Social Development, distinguishes between 'techno-elites' and 'neo-luddites[18].' Two groups that have come into existence, with neo-luddites viewing the use of

[18] A person who resists the advances of technology

information technology as a "tool for renewed exploitation, destruction of jobs, environmental degradation and the invasion of privacy" (Castells, 1999:1). The techno-elite group being characteristically more globally connected. Castells finds that a polarization exists, around those who have IT skills- the *IT rich* and those who do not – the *IT poor*. Castells advocates that our new world of globilisation as well as the information technology revolution is nothing more than a "warmed up version of capitalist ideology". (Castells, 1999:1). Conceding that information technology is not the cause of the changes that we are currently living through and that without any new ICTs, none of what has and is changing our lives would be possible. He goes on to explain that the world "is organized around telecommunicated networks of computers at the heart of information systems and communication processes and that the entire realm of human activity depends on the power of information" (Castells, 1999:2). Individuals who are excluded from accessing this information either due to social reasons or inequality, are seriously disadvantaged. Compaine (2001) on the other hand argues that the Digital divide is only a perceived gap. According to him such technological gaps are relatively temporary and should soon disappear as the knowledge of ICTs will become less important as the technology becomes smarter and easier to use. It follows that in the future people will not need high technological skills to access the Internet etc. This can be seen in the infiltration of cellphones into the lives of both young and old. People have learnt how to use cellphones effectively out of necessity when initially they had no knowledge of such a technology. Compaine argues against spending substantial amounts of money on bridging the Digital Divide. This is in direct contrast to what South Africa is doing in schools at present and can be seen by the phasing in of the extensive Gauteng on Line[19] project in the Gauteng province and the Khanya Project[20] in the Western Cape.

[19] www.gssc.gpg.gov.za
[20] www.khanya.co.za

Does the above debated 'Digital Divide' exist in the South African context? Speaking at an IT Charity event in April 2008, Lindiwe Mabuza, the High Commissioner of South Africa in The United Kingdom, commented that issues surrounding access to and skills in information technology are major contributors to economic and social inequality in South Africa. Her strongly worded address stated that "If South African children do not have [access] to this technology, then the past inequalities of apartheid will continue and that cannot be allowed to happen," and that "In poor communities of developing countries, the idea of touching, let alone using, a computer would be like a child taking the space shuttle to school every day," [21]

The Deputy Minister of Communications, Dina Pule, advised in September 2009 that a Presidential Priority Project in the form of the Presidential National Commission (PNC) on Information Society and Development (ISAD) has been established in order to bring together stakeholders to address the challenges of bridging the digital divide. In addition to the previously mentioned Khanya project, Gauteng Online, as well as the Telezer0 Deal[22], such initiatives would not be in place if a digital divide was not perceived to exist in the South African context.

Besides the obvious divide between those who have physical access to computers, relevant instruction etc and those who do not, a divide is proposed by Marc Prensky between *digital natives* and *digital immigrants*. Having written numerous books and articles on the issue of digital natives and digital immigrants – both terms which he coined, Prensky proposes the following definitions. ' Digital Natives' are people for whom digital technologies already existed when they were born, and hence have grown up with digital technology such as computers, the Internet, mobile phones and MP3s. These students are all 'native speakers' of the digital language of ICTs. Juxtaposed to these students are the older 'Digital Immigrants' who while

[21] **Andrew Donoghue** ZDNet.co.uk Published: 25 Apr 2008
http://news.zdnet.co.uk/hardware/0,1000000091,39405246,00.htm
[22] http://www.theinnovationhub.com/newsbits/vol5no3/news03.cfm

learning to adapt to the environment, retain their 'accent', or foot in the past (Prensky, 2001). I propose that these two terms can also be applied to South Africans. In a Business Day report, the MD of Pearson education, Steven Naude, proposes that the biggest challenge in South African education today is bridging the divide between those born into a digital world and those who were not. He continued with the claim that research and experience have shown that traditional computer-based education has not been very successful in dealing with the challenges of higher education in SA. This is partly because many students are 'digital natives' – people who had never not known a digital world, while their lecturers are 'digital immigrants' – people not born into the digital world, but fascinated by new technology and willing to adapt to using it[23].

I support the argument proposed by the literature that two groups of ICT users exist – those who are adept at using ICTs and those who are not. Whether these two groups can be clearly distinguished according to the year they were born, as Prensky proposes, is for me a contentious issue. Within the South African context, with its legacy of unequal education opportunities, these two groups of digital natives and digital immigrants may arise due to a number of other factors besides the one of age. Other factors to bear in mind include socio-economics, locality, language, gender, culture, race – as well as other aspects which will be explored in more depth in this study. In relation to this study the younger pre-service group of students are likely to be characteristic of the 'Digital Natives' while the older Limpopo group of students are more likely to be characteristic of the 'Digital Immigrants'. The students participating in this study can be clearly defined into two groups based on their age. The average age of the in-service Limpopo group of students is 39 years while the average age of the pre-service group of students is 19 years. That is a difference of 20 years. This component will form the core of this research as these two very different first year groups of first year B Ed students are studied.

[23] http://www.shuttleworthfoundation.org/media-centre/newsletters/july-2008

Although, Prensky (2001), classifies individuals born after 1980 as "Digital Natives', it is clear that age does not always matter as access to digital technologies since birth and the ability to use such digital technologies clearly play a role. Key characteristics of 'Digital Natives' include being creators rather than passive users. These people are more likely to create their own content and share their opinions online. As a result they may possess multiple online identities. There is a blurring between shared online and offline. These people are more inclined to a culture of sharing believing that they not only have a right to speak but also to be heard. Such people possess different information processing habits to the 'Digital Immigrants' as they will be more likely to "graze" headlines than read the full article whereas the 'Digital Immigrant' is inclined to print out the article and read it in a linear logical manner. 'Digital Natives' learn through browsing and wrestling with large amounts of instantaneously available information and as a result they develop good multitasking skills. This peer collaboration is something foreign to the older 'Digital Immigrants' of which the older in-service group seem to be characteristic. It is worth noting here that 18% of the younger pre-service group of students indicated that they had accessed an online social networking site such as Facebook within the last three months. This was vastly different to the one older in-service student (0.7%).

Generation Y (Naidoo, 2005) is the name given to the group of people born between 1980 and 2000. This is consistent with Prensky's 'digital natives' and the pre-service group of students would be typical of this Generation Y group having grown up in a time during which the internet caused great change to all traditional media. First used by the general public in 1988, the pre-service group of students grew up surrounded by the tools such as blogging, social networking and instant messaging that come with the Internet. Also referred to as the *Millennials,* these students display ambition, confidence, optimism and a capacity for high-level co-operative work students (Strauss and Howe, 2000). Junco and Mastrodicasa (2007), expanded on the generation

theory work of Strauss and Howe with the view that this Millennial Generation presents unique challenges to tertiary institutions as they have never known a world without pervasive computer and communications technologies. As children of the Baby Boomers (now often known to us as "helicopter parents"), members of the Net Generation have also lived highly structured and sheltered lives. Like their grandparents in the Silent Generation, they are often team-oriented, civic-minded, optimistic, and more willing to respect and work with authority.

While it would be reasonable to assume that current technologies isolate students from each other as they spend so much time online, in front of a computer screen, rather than face-to-face with their peers, the results of studies that Junco and Mastrodicasa (2007), conducted prove the contrary as they report significantly *higher* levels of interaction with faculty—as well as higher expectations that they will have such interactions—and greater comfort communicating with others (albeit *not* fact-to-face). It is also proposed that Millennial students devote such a large amount of time to the use of technology that through this constant use of the technology throughout their developing years has "rewired" their brains to allow effective multitasking (Prensky, 2001). Junco and Mastrodicasa offer a number of practical recommendations as to what teaching methods best reach students who prefer to spend their time in front of a screen instead of a book or a lecturer.

Sayayo, Santos, Gonzalez, Arenas and Lopez (2007), conducted research into whether older people learn differently and although they focused predominantly on the elderly, I would like to explore the issues they raise as it is apparent that the majority of my older group of research subjects have not studied in a while. They highlight the importance of peer support as the scaffolding mechanism for the older students' entry into the technological learning environment. Community of Practice (often abbreviated as CoP) is a concept that refers to the process of social

learning that individuals experience as well as the shared socio-cultural practices that emerge and evolve when a group of people interact in a group or community.

The construct Community of Practice (CoP) was founded on the work of Jean Lave, who attempted to explain and describe learning that occurs in apprenticeship situations. Later, Lave, in collaboration with Etienne Wenger originated the concept legitimate peripheral participation. It is a description of how the newcomers become experienced members and eventually old timers of a community of practice. N*ewcomers* or *novices* enter a community of practice and attempt to acquire the socio-cultural practices of that community. It would be valuable to explore how the older Limpopo students who are generally *newcomers* to ICT practice are helped by the already digitally aware younger pre-service students who would be the *masters* or *old timers* in this scenario. Through working in groups these students are enabled to discover new things by sharing their knowledge with their peers.

Lave and Wenger argue that people operate and exist within communities of practice, and that it is by entering these communities of practice that people learn. For people to achieve mastery of skill and knowledge within a community of practice, novice learners adopt the socio-cultural norms of a community. Lave and Wenger argue that in this context, learning is an integral part of practice. This implies a relationship between learning, the artefacts of practice[24], and the social relationships that create a community.

Throughout the literature it is evident that the assumed barriers a student may encounter when accessing ICTs are a lot more numerous and complex than initially identified. These barriers also appear to be interrelated and a student may experience a number of different barriers simultaneously. While focusing on the barrier of age when describing the difficulties the older

[24] Man-made tools

group of in-service students may experience, it is important to bear in mind that there are numerous underlying factors that come into play. It is possible to deductively make generalisations with regards to how the older in-service group experience ICTs compared to the younger group of students, but these generalizations can only be accepted if explicit reference is made to the possibility of other factors also influencing the issue of access.

Darkenwald and Merriam (1982), identify four general categories of learning barriers in adult learning which may be relevant to examine here considering 19% of the first year student group are over the age of 30. These proposed barriers are *situational barriers* which relate to an individuals life context at a particular time, for example, cost, lack of transport, lack of childcare, lack of time as well as geographical isolation. *Institutional barriers* include inconvenient schedules, lack of appropriate courses as well as institutional policies and practices that impose inconvenience, confusion or frustration on adult learners. *Informational barriers* arise when the institution fails to communicate information on learning opportunities to adults. *Psychological barriers* are individually held beliefs, values, attitudes or perceptions that inhibit participation in learning activities. The student may feel that he or she is too old to learn or afraid to use ICTs. It would be beneficial to relate the barriers identified in this study to the above adult learning barriers to see if there is any correlation.

Language:

In addition to the four barriers (physical, human, socio-economic and digital) as identified by the eDivide team at the beginning of this chapter another barrier that arose in the literature is that of **language.** Martindale (2002), in an article for a Linux journal promoting a non-profit open source translation project in South Africa, raises an interesting concept of language being a barrier people encounter when accessing ICTs. Powerful comments are made regarding the

divide language imposes on the use of technology and Martindale argues that navigating the digital world is daunting for first time users without having to do it in a language that is not their home language. This project, translate.org.za, founded by Dwayne Bailey[25], focuses on the localization of open source software[26] and has released the popular word-processing, spreadsheet and presentation software OpenOffice.org, web browser Mozilla Firefox and e-mail programme Mozilla Thunderbird in the 11 official South African languages. The first all-South African language keyboard has recently been created and is rated as the world's first. Venda (one of the official languages) cannot be accurately typed on traditional keyboard but this has now changed with the development of this new keyboard. Translate has also made 'spell checkers' for all 11 languages.

One of the great challenges in the contemporary South Africa is the language issue. During the apartheid period, it would appear that language policy was used for political purposes to further separate different learner groups. English has predominantly become the language of learning and teaching and this is also true at Wits. It is a commonly held belief that everyone in South Africa understands English and therefore English should be the dominant language in the education system. The lack of linguistically appropriate educational software is an important issue as Keniston (2001), points out in his study that in order to minimize the power structures between the rich and poor, software that ensures the content of the Internet is meaningful for different language groups needs to be developed. This is addressed by Thabo Mbeki's Presidential National Commission on Information Society and Development when he advises that "care should be taken not to perpetuate the domination of nations of the world by certain languages and cultures." To ensure that all communities feel part of the global information

[25] www.rxpgnews.com/india/South-African_language-innovators-bridge-digital-divide_6455.shtml
[26] Free to download and use

society, the content on ICTs needs to be relevant and appropriate to all communities as well as being available in their languages (PNC on ISAD, 2009).

Eliminating language barriers is critical to enabling new users of technology to focus on that learning curve; it is steep enough, without having to understand information delivered in a foreign language. The same sensitivities should also apply to all aspects of national and cultural identity (IDEA 2007). While Barnard, Cloete and Patel (2003), state that not withstanding the fact that the people of South Africa speak 11 distinct languages, there are wide disparities within and between the various groups in socio-economic standing and literacy. Bailey is relieved that "finally after years of hard work promoting the importance of mother tongue languages in ICTs, it is fitting that language has been recognized as a critical part of the digital divide"[27] as it has always been his dream that one day South Africans would be using ICTs in their mother tongue. Bailey feels that this has resulted in increased language pride as people now see their languages as modern and relevant.

Before this translation initiative software programs are written for English speakers. A novice ICT user is already disadvantaged when he faces using ICTs and receiving instruction on the use of ICTs in a language that is not his / her home language. Czerniewicz and Brown (2006) have also conducted research into this area and argue that it would be greatly beneficial for the learners if more emphasis would be placed on the language issue in the South African context. They go on to state that they are "astounded that the paucity of relevant local digital content is not considered a matter of concern, and that students do not bemoan their lack of access to suitable, locally produced contextually relevant content in the languages of their choice" (Czerniewicz & Brown,

[27] www.rxpgnews.com/india/South-African_language-innovators-bridge-digital-divide_6455.shtml

2006: 136). There are very few documents available on the Internet in African languages, written by Africans themselves.

It should be the right of every learner to get the opportunity to learn and be taught in his / her mother tongue which would take South Africa closer to educational equality as is identified in the constitution. However, as long as there is limited localization of content which does not take into account all the different languages, the status of English will continue to have the upper hand and will continue to be a hindrance for the learning process and ICT competence of all learners (Gudmundsdottir, 2008).

There is a need to move away from being a mono-linguistic society as people are unable to be spontaneous, creative and self-confident if they cannot use their first language. (Martindale, 2002). Learning something in your mother tongue is naturally easier and while the issues that surround language, inequality and poverty are broad and impact every sphere of life. Bailey (in Martindale, 2002) acknowledges that translation does not remove all barriers to ICT access, but points out that at least it helps to eliminate one. Bailey feels that this, together with low cost computers, open source software and low cost internet access will go a long way to making a dramatic IT impact on South Africans, especially the disadvantaged.

There is hope that efforts made by projects such as www.translate.org.za and declarations such as that made by the African National Party (ANC) that all the eleven official languages of South Africa have equal status[28] can address the language barrier that South Africans face when accessing ICTs. What implication does the above hold for my research population? Could it be deduced that the younger pre-service group have a greater proficiency in English and therefore do not experience the barrier of language when accessing / using ICTs? It is worthwhile noting here that 19 % of the total research population indicated that English is their home language. Of this total percentage, 0% of the older in-service group stated that English is their home language,

[28] The Constitution of South Africa, 1994, p.6.

rather 66% speak Sepedi, 21% Xitsonga and 9% Tshivenda.[29] English is the home language of 26% of the younger pre-service group. While one would expect this language issue to be a dominant barrier that the two student groups encounter when accessing ICTs, surprisingly it was not highlighted by either group as significantly constraining their ICT usage. Brown and Czerniewicz, 2007, attribute this to their research findings that students do not comment on the amount of and adequacy of content available in their home language possibly due to the fact that they regard English as the lingua franca of academia and that indigenous languages are regarded to have lesser status. .

Location:

Not only are South Africans diverse in the languages they speak wide they are also geographically wide spread. People living in rural areas are less likely to have access to computers and the Internet when compared to urban areas. Some of the students in this study pointed out that they do not even have electricity in their schools and homes in the rural areas. The language that is spoken in a rural area will also impact on the students' access as well as the socio-economics of a rural area. These areas are more likely to be economically depressed and there is often a lack of infrastructure in rural areas. Individuals are denied opportunities to interact with and familiarize themselves with ICT devices as these areas will have limited or no Internet access (NetTel, 2004). While fair access may be available on campus, one needs to bear in mind that the students come from and live in unequal worlds off campus where access to ICTs may be unequal, perpetuated by disadvantage (Brown and Czerniewicz, 2007).

Formulas for introducing hardware, infrastructure, training and applications become problematic in the face of dramatic differences in environment and culture in areas too remote to have them already. Poverty there can keep commercial interests from seeing such areas as "markets", an

[29] Data available on page 67

important motivation for obtaining corporate support while some governments just see technology as a luxury for affluent citizens not as a tool for national development (IDEA, 2007).

Culture:

In addition to the multi-lingual nature of the country, conventionally, South Africa is made of people of differing cultures[30]. Evidence of this is the existence of numerous divisions within the Bantu tribe which include Zulu, Xhosa, Ndebele, Sotho, Venda, Pedi, Tsonga, Tswana, Swati. Therefore acknowledgement needs to be made that some individuals may be barred from using ICTs due to cultural beliefs which are often linked to gender issues.

Technophobia:

Technophobia can be seen to be a barrier that people may experience as they fear the computer and are resistant to using ICTS because it is assumed that it is too difficult to use or because an individual's first experience with such devices may have been unpleasant. NetTel (2004) states that one of the reasons individuals may not use ICTs is due to ignorance or lack of awareness of how ICTs may assist them.

Illiteracy:

South Africa has a high percentage of uneducated citizens. Illiteracy rates[31] are very high and NetTel predicts that these illiteracy statistics will be drastically reduced if technical or ICT skills are imparted to most members of society. NetTel continues to argue that people shouldn't just

[30] http://wiki.answers.com/Q/How_many_different_cultures_are_there_in_South_Africa

[31] Illiteracy rates are high at around 24% of adults over 15 years old (6- to 8-million adults are not functionally literate) – **South Africa Info website** http://www.southafrica.info/about/education/education.htm (accessed 17th June 2009)
Some 32% of the adult population can be regarded as functionally illiterate - **University of KwaZulu-Natal Centre for adult education report** http://www.ukzn.ac.za/cae/caepubs/JJWAAH04.pdf

gain access to ICTs, but should also have the opportunity to learn various ICT applications to ensure that they can be employable which will reduce the high unemployment rate[32] in South Africa which they estimate is currently at over 40%

Gender:

As already mentioned, gender barriers are linked to cultural beliefs and these result in women's access to ICTs being more problematic and complex than simply making ICTs available. These barriers include literacy, education, language, cost, locality, the perceived role of women as well as technophobia.[33] Some women are more competent in using ICTs than men so these barriers cannot be seen as inherent in the female condition, nor are these barriers uniquely experienced by females. However, these are barriers that exist widely and more severely for women, particularly in Africa. These obstacles may be deeply embedded in cultural practices such as denying school opportunities for girls, which is where the ICTs are most likely to be and where they will learn to read (Colle and Roman, 2002). These barriers may eventually disappear as cultural practices begin to change, but this may take a couple of generations. Liu and Wilson (2001) identified five barriers that may restrict women in their use of ICTs. These are family responsibility, gender stereotypes and attitudes, working time constraints as well as a lack of confidence and a lack of IT skills. Women are also perceived to have high ICT anxiety with males displaying a more positive attitude toward ICT usage than females. As Godard (2000) pointed out earlier, ethnic minorities do not generally fall into the group that uses ICTs. The extent of this barrier in this study will have to be investigated further.

[32] South Africa's unemployment rate dropped slightly to 21,9% in the quarter ended December 2008 – **Mail & Guardian 2nd March 2009** http://www.mg.co.za/article/2009-03-02-stats-sa-unemployment-rate-down

[33] A fear or dislike of advanced technology or complex devices, especially computers (Merriam-Webster Online dictionary)

2.4. Conclusions drawn from the literature:

Barriers should be thought of as obstacles, wither actual or perceived, that the students / research participants encounter when accessing ICTs on the WSOE campus. It is not possible to assume a Reductionist view that these possible barriers act in isolation in a student's experience. It must be accepted that these identified barriers can co-exist at the same time. While these assumed barriers are more numerous and complex than initially thought and while they impact on the individuals' access to and experience of ICTs, they also are linked to and influence each other. According to Darkenwald and Merriam's (1982), four general categories of learning barriers are present in adult learning. Socio-economics, physical, locality and digital issues may be examples of their *situational barriers*. Technophobia would be seen as a *psychological barrier.* I argue that age, gender, race, language, cultural as well as literacy issues fail to fit into the remaining *Institutional barriers* and *Informational barriers*. As a result this study cannot easily "fit" into any pre-existing frameworks. There are multiple factors that impact and influence a students usage of and experience with ICTs. These factors interact on different levels within an individuals experience and this cannot be ignored or minimized.

Following with this insight of Critical Realism, is a view of the world consisting of hierarchical ordered strata within which each level is constituted by less complex systems, yet constrained by more complex systems (Moll, 2004: 56). In this study I propose that multiple overlapping agents or generative mechanisms impact on each other in producing the phenomena / barriers that students experience when accessing ICTs. While such an approach assumes that causal relations between the variables exist, it attempts to explain how phenomena are related to and explained by the structures underlying them (Norrie, 2005). This view of the ways in which phenomena are grounded in underlying processes, structures and conditions has strong possibilities for this study. A situation in this study has been produced – that of a distinction between the experience of the older in-service students in accessing ICTs and the younger pre-service students' experience. It

is not possible to hypothesize that age alone is the only barrier that one of the groups of students may experience when accessing ICTs without taking into consideration other generative mechanisms such as language and socio-economic status for example. In addition to the obvious barriers as identified above, underlying attitudes (reasons for action) also impact on a student's experience of and access to ICTs. Sims, Powell and Vidgen (2002) mention cultural and gender differences stating that females are more conscious in the use of technology and do not incorporate as many technological courses into their studies as males would. As the population being studied is predominantly female (71%), this will be difficult to verify in this study. Godard (2000) sees the culture of ICT as being generally young, white, middle class male and not working class, older, female or ethnic minority. The older in-service Limpopo group of students is characteristic of this latter generalization.

Chapter 3: Research Design:

In light of the above literature, it is evident that many barriers / obstacles exist and are likely to be experienced by the students in this study. The relevance of the posed research problem as to whether the first year B Ed students face any barriers when accessing ICTs on the WSOE campus is validated. It has already been established that two distinct groups of research subjects exist – the older in-service group and the younger pre-service group. Further discussion and exploration will be made into whether the barriers identified in the literature are experienced differently by these two groups.

3.1. Research Process:

A Description of the Research Process:

A research synthesis problem was formulated and a questionnaire was drawn up with the specific aim of investigating the stated research problem and of answering the research questions. This questionnaire was administered to all the first year B Ed students present in their Education core lecture on Monday 16th March 2009 in the Exams Hall on the WSOE campus. Participation was voluntary and students were assured of confidentiality as the questionnaires did not require any name to be written down and therefore were completely anonymous. The completed questionnaires were separated from incomplete ones and the student responses were captured in an Excel spreadsheet. The data was analysed according to the research questions through a filtering process and the findings presented in Chapter Four of this study. The interpretation and discussion of these findings is presented in Chapter Five of this study with a conclusion and possible recommendations proposed to the posed research problem in the final chapter.

Research Design:

The use of a mixed-method research design which combines both qualitative and quantitative methods is employed in this study. Statistical quantitative results were obtained by closed questions but these were deepened by the qualitative comments made by students when asked for their opinion, feelings and experiences on the questionnaire.

In such an explanatory design, the thrust of the study is quantitative yet the qualitative data gathered is used to further elucidate, elaborate on or explain the quantitative findings (McMillan & Schumacher, 2006). A comparative study as to the experiences of the older group of in-service Limpopo students to the younger pre-service group of students was made.

There was no random selection from the population as all students that were accessible and present on the day the questionnaire was administered took part in the study. Percentages have been used to compare the two groups rather than reducing the younger cohort of pre-service students to the same group size of 136. I did not want to employ a sampling technique but rather survey the entire group of students in an effort to enrich the study with as many possible relevant barriers being identified as possible.

Reasons for the use of a questionnaire as an instrument of gathering data were threefold. Firstly the group of students was extremely large and as the results needed to be representative of the first year B Ed group, there was a need to survey as many of the students as possible as quickly as possible. The previous experience of the students' use of ICTs needed to be established before this prior experience or lack thereof was negated by exposure to ICTs on the WSOE campus. Secondly, general patterns between the students needed to be established in order to attempt to answer the posed research problem. Thirdly it was hoped that the results would be quickly available so that through an analysis of the findings the course presenter would be more knowledgeable / adept in the delivering of the Computer Literacy course in the face of such a wide discrepancy in skills and prior experience of ICTs.

Chapter 4: Data Collection Design and Methodology:

4.1. Demographics

		Gender		Race				
	Ave age	**Male**	**Female**	African	White	Indian	Coloured	Asian
In-service Group	39 years	**6%**	**94%**	100%	0%	0%	0%	0%
Pre-service Group	19 years	**38%**	**62%**	71%	18%	5.7%	5%	0.3%
Total	25 years	**30%**	**70%**	78%	14%	4.5%	2.5%	1%

Table 1: Comparison of first year B Ed student group with regards age, race and gender.

The study comprised of 524 first year B Ed students of within which 136 in-service Limpopo group students and 388 pre-service students were identified. The gender split was 70% female and 30% male with the majority of students, 78%, being Africans. This was anticipated as teaching is traditionally seen as a female occupation. The students spoke a diversity of languages with Sepedi (24%) being the dominant home language. The other majority languages included IsiZulu (20%), English (19%) and Xitsonga (10%). A more detailed analysis of the language breakdown of the students is provided on page 69.

Two distinct groups emerged. The first group being the older in-service group of students which were studying full time at WITS in order to obtain a four year B Ed degree. This situation is unique to this 2009 first year B Ed intake. As already explained, this group of in-service students originate from the Limpopo province. A province in which Sepedi is the dominant home language which accounts for 66% of these in-service students stating that they are Sepedi speakers. 94% of the in-service group are females which is in accordance with the fact that Foundation Phase teachers are predominantly female. As this group comprises of qualified practicing teachers who are being re-educated in a Limpopo Education Department initiative, it is not surprising that the average age of these students is 39 years old.

The diversity of the younger pre-service group is characteristic of a large group entering the B Ed degree shortly after matriculating. The average age of this group is 19 years old. A wide variety of languages are spoken and this group is representative of the numerous South African race groups. 62% of the pre-service students are female and 38% male – confirming the fact that the majority of teachers are women.

4.2. Data Collection:

4.2.1. Measures and Procedures:

The quantitative questionnaire was voluntarily and anonymously completed by the first year B Ed students. This questionnaire was administered during one of their whole group lectures. During this lecture, the older Limpopo students staged a 'sit in' on the lawn outside the administration building in demonstration to the transport issues they were experiencing. Of the 774 first year B Ed students 567 questionnaires were returned. Of these 41 were disregarded as they were incomplete. The resulting breakdown revealed 388 usable pre-service questionnaires, representative of 70 % of the pre-service group and 136 in-service questionnaires, representative

of 63 % of the in-service group. Due to these percentages, the completed questionnaires were considered to be representative of both groups.

4.2.2. Validity and Reliability:

The entire population of each group of students was investigated. No sampling took place. As a result of the differing size of the two populations, the results have been presented as a percentage in this study. Validity refers to the degree to which scientific explanations of phenomena match reality as well as to the truthfulness of the findings and conclusions (McMillan & Schumacher, 2006). Although all the students in the study completed the questionnaire on the same day at the same time after having been given the same instructions, as mentioned earlier, the one group of students (in-service group) were staging a 'sit-in' due to being unsatisfied with transport arrangements from their residence Stay City to campus. The researcher does not attempt to negate the impact that this situation may have had on the students' responses when completing the questionnaire but points out that the questions asked in the questionnaire were unrelated to the issue of transport and as a result any influence would be considered to be minimal in the final study.

The researcher had no existing bias with regards the participants / students or about the topic being researched. The students were aware they were being studied and the researcher is confident that the students were honest in their responses to questions posed on the questionnaire. The fact that up to this point that no student has removed their questionnaire from the study is also evidence of honest responses and willingness to participate in the study.

External validity refers to the generalizability of the results (McMillan & Schumacher, 2006). With regards Population, the participants in this study have certain characteristics. They are all first year full time students studying a Bachelor of Education degree at the University of the Witwatersrand on the Wits School of Education campus in 2009. Uniquely there is a group of in-

service previously qualified students from the Limpopo province. It would then follow that the results from this study can be generalized to other populations that have the same or at least similar characteristics as the participants / students in this study.

Due to the Ecological External Validity, the generalization of results of this study are limited to similar conditions of this research (McMillan & Schumacher, 2006). The researcher does however argue that the findings of this study can be reasonably generalized to similar populations.

Reliability refers to the consistency of measurement and when measuring human attitude there will be some degree of error in this regard (McMillan & Schumacher, 2006). A question on the questionnaires required the student to respond emotionally using one word to describe how he or she felt when using ICTs as well as providing a personal justification as to how important he or she felt ICT usage was in the classroom. Responses such as these may have differed should the student have just had a negative experience in the use of ICTs, but such errors are unavoidable and beyond the researchers control. The students were also asked to provide their personal opinions on how important they felt the use of ICTs were in the classroom as well as to describe possible barriers that they felt made it difficult for them to access ICTs.

4.2.3. Ethical Consideration:

Ethical consideration was made by ensuring that all the questionnaires are anonymous. The students were also advised that they were able to withdraw from the study at any time without facing any repercussions. Information about the nature of the study was provided in advance and completion of the questionnaire was completely voluntary. All participants were over the age of eighteen so permission did not need to be obtained from their guardians. In total 73% of the students completed the questionnaires.

4.2.4. Procedures and steps taken to carry out the study:

A questionnaire was devised[34] in which the students provided general demographic information such as age, race, gender and home language. The students were asked to indicate their current access to computers and the Internet either at home or in the residence - a quantitative response such as *daily*, *weekly*, *monthly* or *never* was required. Further elaboration on their previous and current experience with computers was asked for and these responses were used to establish which students were novice ICT users. The students then identified applications that they had heard of and which they felt they were competent working with. They indicated applications that they had worked with during the last three months, such as having played a computer game, sent an e-mail, used wordprocessing software, to name a few. Students were asked how many courses they had up to that point been required to hand in a typed or computer generated assignment for. A focus of this study is the students' access to ICTs on the WSOE campus and they were asked to describe this access both quantitatively and provide a qualitative comment. The students were also asked to provide a description as to how they 'felt' when working on a computer and from these interesting findings were made as to whether the students positively or negatively experienced ICTs. Barriers to the use of ICTs being the focus of this study, the students were asked to identify what made it difficult for them to use ICTs effectively. I did not specify barriers that the students might encounter for the specific reason that I did not want to preempt their responses. As a result some interesting responses and unexpected barriers were identified. The consistency of these student identified barriers across the research sample is made evident later in the sample. Surprisingly, barriers not detailed in the literature arose. Juxtaposed to this, they were asked for comments on what they felt made it easy for them to use ICTs effectively. Lastly they were asked to comment on how important they felt ICTs were firstly, in

[34] Appendix A

their teaching and classroom and secondly, how important it was being skilled using a computer and its applications in their teaching careers.

Chapter 5: Presentation and Analysis of Findings:

5.1. Techniques used to analyse the data:

The student responses to the questionnaires were entered into a spreadsheet. Routine demographical information such as age, gender, race, home language, highest qualification etc was captured. Two groups of students were defined – the older in-service group and the younger pre-service group. The data for each of these two groups was compared. The data was filtered according to certain criteria defined by the research questions for example: *how many students had indicated that they had access to a computer off campus*. Comparisons were then made between the experiences of the two identified groups: - the younger pre-service group of students and the older in-service group of students. These results were then able to be quantified and represented as a percentage.

The Chi-Square Test was employed to validate the data. This test was applied to a single categorical variable from two different populations. The pre-service group of students and the in-service group of students. Using the Chi-Square Test investigations were conducted into whether the frequency counts were distributed identically across the two different population groups. If they were not, then further considerations were made into the extent to which they differ.

As has been previously indicated, two groups of students emerged in this study; the older in-service group of students and the younger group of pre-service students. The research problem proposes a study into whether age plays a factor in the barriers that students may face when accessing ICTs on the WSOE campus. For this reason findings from the responses students participating in this study made will be indicated according to these two different groups of students.

5.2. Data Analysis Approach:

I, the researcher assume that multiple causal agents operate as generative mechanisms at various levels: social, socio-economic, cultural, digital, etc. whilst bearing in mind that these generative structures of the world exist independently of conventional constructions of them.

5.3. How do pre-service and in-service students describe their feelings about using ICTs?

The students were asked to indicate how they felt when using a computer using just one word. Through analysis of the comments I was able to assign a positive, negative or neutral value to the response. I was interested in establishing whether the older in-service group experienced more positive or negative feelings when using ICTs than the younger pre-service group with the assumption that students for whom using ICTs is a positive experience will experience less barriers. The following were positive comments made by the students:

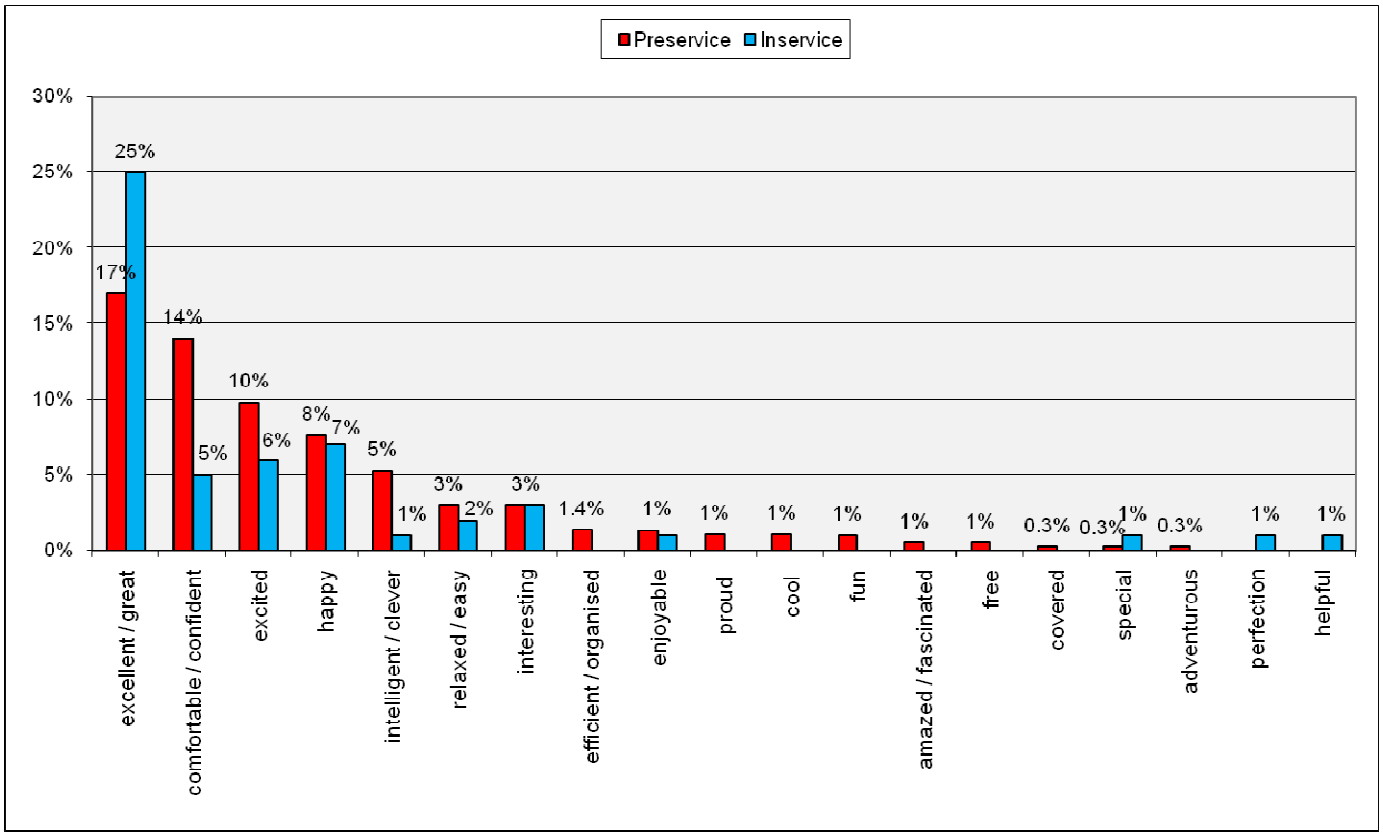


Figure 1: Positive comments made by first year B Ed students (Pre-service group compared to in-service group of students)

The majority of both student groups commented that they felt *excellent* or *great* when using a computer. More of the younger pre-service students commented on feeling *confident* (14%) and *comfortable* than the older in-service students (5%). Comments such as feeling *happy*, *clever*, *relaxed* or *easy*, *interesting*, *enjoyable*, *special*, *perfection* and *helpful* were indicative of the older in-service group. Such comments indicate that there is a degree of satisfaction and enjoyment experienced by such students when using ICTs. The younger group of pre-service students similarly made comments with regards feeling *excited, happy*, *clever*, *relaxed*, *interested*, *enjoyable*. In addition, the younger group of students also used terms such as feeling *efficient* or *organized*, *proud*, *cool*, *fun*, *amazed*, *free*, *adventurous*, and *covered*.

In the analysis of the comments, a negative value could be assigned to some of the comments made by the two student groups in response to this question:

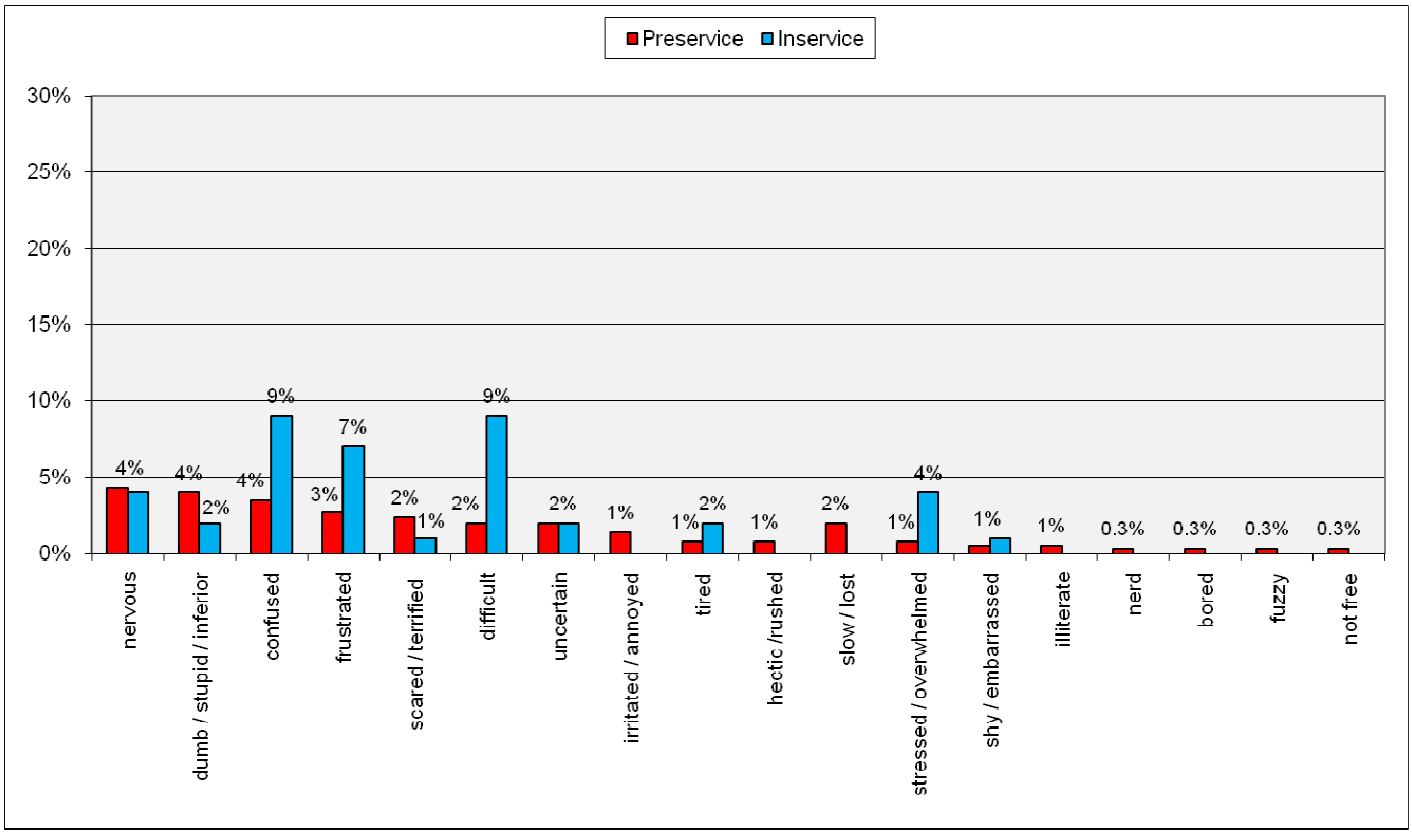


Figure 2: Negative comments made by first year B Ed students (In-service group compared to pre-service group of students)

While the younger pre-service group of students' comments were fairly widespread, the older in-service group of students comments focused mainly of emotions of *nervousness*, *confusion*, *frustration*, feeling *overwhelmed* as well as experiencing some form of *difficulty*. Some students also commented on feeling *stupid* or *inferior*, *terrified*, *uncertain*, *shy* or *embarrassed* and *tired*. It is evident from such comments that using ICTs can be an extremely anxious experience for such students. By identifying barriers that prevent or hinder students in accessing ICTs these comments may be explained. Student attitude in itself may be a barrier preventing students from using ICTs. The student may be extremely anxious when using ICTs for the first time, this anxiety in itself may act as a barrier to the effective use of ICTs, other factors or barriers may impact on this initial experience, such as the student in question not receiving any assistance from a peer or the tutor, or being situated in a very noisy environment in which he or she battles to concentrate. In such a scenario the feeling of anxiety is reinforced and as a result the student repeatedly battles to effectively use or access ICTs and the cycle of non-performance is established.

Some comments could not be assigned either a negative or a positive value and for that reason there are presented in this graph as neutral comments:

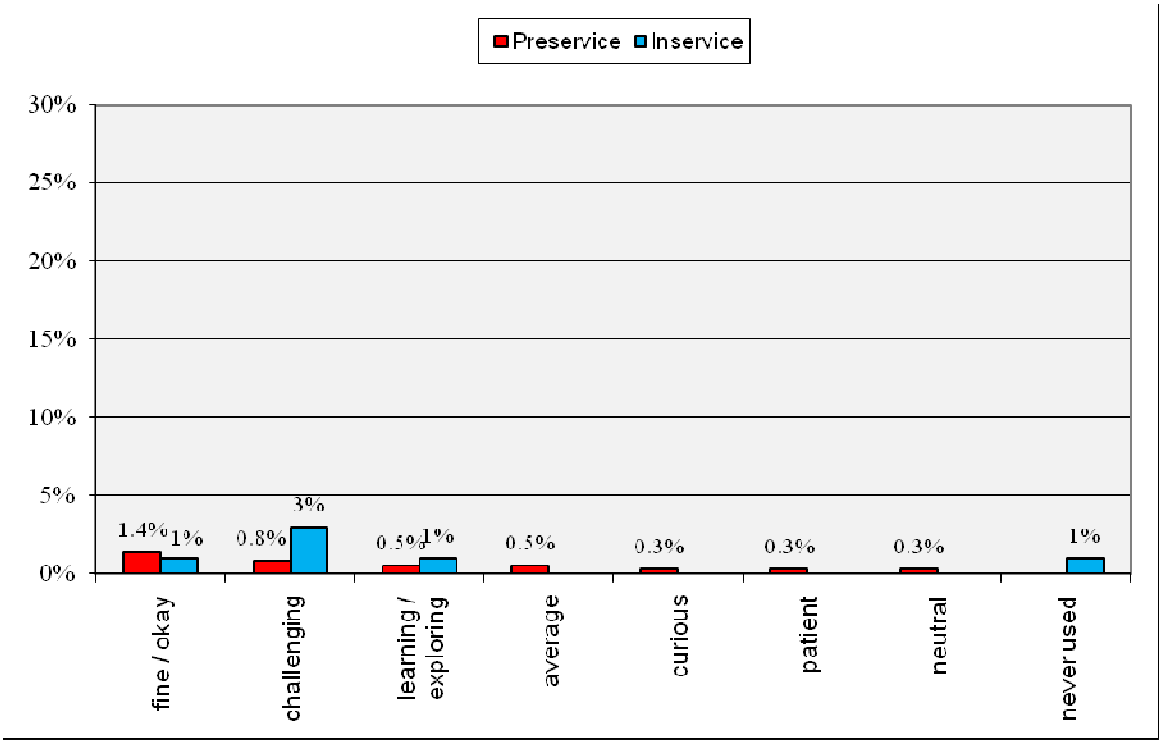


Figure 3: Neutral comments made by first year B Ed students (In-service group compared to pre-service group of students)

The word *challenging* could be both viewed in either a negative or a positive light. As the students only wrote one word describing their feelings, it was impossible for the researcher to have any elaboration on the meaning / implication of this word.

By looking at the data set out in figures two to four, it is evident that some students experience ICTs negatively. This study would propose that these negative feelings such as *nervous, dumb, stupid, scared, frustrated,* to single out a few, may be the result of barriers or obstacles that the students / research participants encounter when accessing ICTs both on the WSOE campus or have encountered in the past. When the barriers are identified later in this study, these comments will illuminate the challenges both physically and mentally that the students face.

The following graph serves to compare the frequency of positive comments made by the two groups.

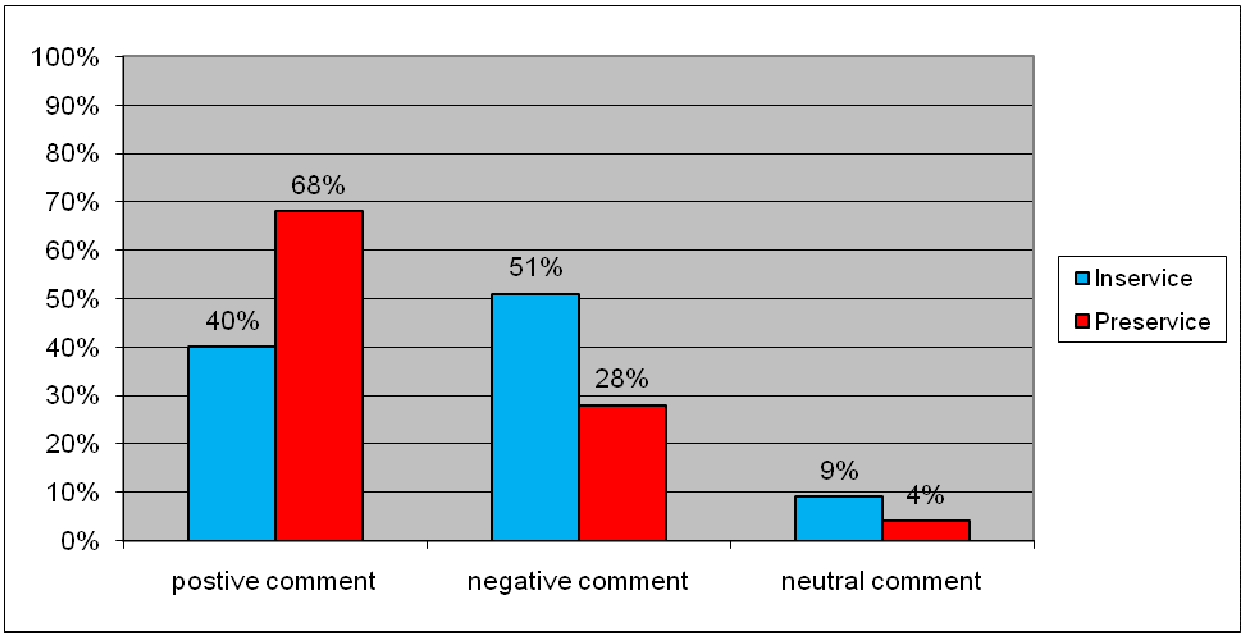


Figure 4: Comparison of comments made by first year B Ed students (In-service group compared to pre-service group of students)

It is evident that the younger group of pre-service students feel more positive (68%) when using ICTs than the older in-service group (40%) of students. This is in line with assumptions that the younger group of students may find it easier to access ICTs, face fewer barriers than the older group and therefore feel more comfortable in the use of ICTs. The quote on the first page of this study regarding whether old people hate computers, i.e. feel negative towards them and whether young people love them – feel positively towards them, would appear to have some substance here. The implications of this quote is deepened by the statistics in the graph above that 51% of the older in-service group of students expressed negative comments compared to only 28% of the younger pre-service group.

5.4. Barriers faced when accessing ICTs:

The students were asked to comment on what they felt made it difficult for them to use ICTs effectively. All of the comments were captured and common threads established. From these responses nine categories or headings were established under which these comments could be

classified. Some of these barriers are concurrent with those identified in the literature, with a few interesting barriers unique to this research population being identified as can be seen in the table below.

	Lack of Skill (Lack of knowledge and previous training)	**Lack of Access** (Computer labs full & not owning own computer)	**Technical Problems** (Internet slow, hangs, do not have connectivity, computer crashes. Power-cuts, new versions of software programs, viruses)	**Poor Typing Skills** (Not being able to type quickly or properly)	**Lack of Assistance** (No help from lecturer or peers. Lack of a manual)	**Noise** (Other students making a noise in the lab)	**Physical Issues** (Poor eyesight)	**Everything**	**Nothing**
In-service students	**34** 25% (10)	**92** 68% (83)	**0** 0% (15)	**3** 2% (7)	**7** 5% (0)	**0** 0% (2)	**0** 0% (1)	**0** 0% (0)	**0** 0% (5)
Pre-service students	**190** 49% (4)	**50** 13% (29)	**58** 15% (5)	**43** 11% (2)	**16** 4% (0)	**8** 2% (1)	**4** 1% (0)	**1** 0.3% (0)	**18** 4.7% (2)
Total	43%	27%	11%	8%	4%	1%	1%	1%	4%

Table 2: Barriers to accessing ICTs as identified by first year B Ed students - Actual student responses have been indicated in bold. Expected frequencies have been indicated in parentheses. The percentage of the response across the whole research sample has also been provided.

The information contained in the table is important as relevant barriers that this particular population of students experience when accessing ICTs are identified. It is evident from the above table that a lack of previous skill and experience with ICTs is felt keenly by the younger students to hinder their current ICT usage. While it was expected (through the Chi Square test) that four of the pre-service students would indicate that they felt a lack of skill would hinder their

ICT usage, surprisingly 190 actually indicated this. Could this be attributed to the younger pre-service students realizing the importance of possessing and practicing their ICT skills while the older in-service group of students specify a key barrier as being the lack of access to ICTs? They mention not having their own computer at home or in the residence they are staying in and the problem of finding the WSOE computer lab full when they want to work on the computers. The socio-economic aspect of possessing a home computer is relevant here.

The Chi-Square test investigates whether the frequency counts are distributed identically across the two different populations, namely the group of pre-service students and the group of in-service students. An alternative hypothesis that a difference in the barriers experienced by the two groups has been suggested in opposition to the null hypothesis of there being no difference in the barriers experienced, i.e. both groups experience the same barriers. In the event of the frequency counts not being identical, an investigation has been conducted into the extent to which these counts differ. (Chi-square: 165.27; DF: 8; p-value<0.05)[35] confirms that there is a significant difference between the data sets that cannot be due to chance alone and the null hypothesis is rejected. The conclusion that may be drawn is that the in-service students and the pre-service students differ in their perceptions of the barriers that hinder their ICT usage. These barriers are elaborated on in the text that follows.

The first barrier that was identified by the students was that of a **lack of skill** in the use of ICTs and not having had any previous training in the use of ICTs before. Reasons for this apparent lack of skill could be seen to be a *digital* barrier – an inability to utilize ICTs effectively. It is necessary to bear in mind that while on the surface these students may not have received adequate training in the use of ICTs, underlying reasons exist as to why this is so. These could be any of the possible barriers presented in the literature:- lack of human resources in terms of

[35] Calculations provided in Appendix D

skilled trainers, language issues, living in rural and digitally underdeveloped areas to name but a few. These comments are used to illustrate rather than be representative of students' opinions:

- "*I am not computer literate.*" (38 year old in-service student)
- "*Because I lack training and knowledge*" (unknown age in-service student)
- "*I don't know where to start*" (40 year old in-service student)
- "*I don't know computer language*" (40 year old in-service student)

More of the young pre-service students (49%) detailed a lack of skill in the use of ICTs as being a barrier compared to the older in-service group (25%). One would assume that the younger pre-service group have had more opportunity to have had ICT training in the past at their secondary / high schools than the older in-service group of students who matriculated on average 20 years ago.

Problems of **physical access** to ICTs on campus is the second barrier raised. Perhaps this awareness of not possessing the required skill is telling in itself of the younger group of students being more aware of the necessity of possessing basic ICT skills in order to succeed in their ICT usage whereas the older group is more concerned about their lack of access to ICTs. If the students have not had and are not able to access computers physically and therefore have no experience of ICTs, it follows that they may not be aware of the necessity of possessing basic ICT skills. The older group of students complained that the computer labs on the WSOE campus were always full and that not owning their own computer made it difficult for them to be able to practice their skills on a computer. Grounded in the physical barrier raised in the literature, applying a multiple causal approach, it is necessary to acknowledge that on the surface this lack of physical access may be the result of underlying causes which include such students being in a low socio-economic bracket, perhaps having technophobia and the resulting fear of using ICTs, even age could be relevant here. These are students who have not grown up in a digital world

and could be described in Prensky's terms as being *digital immigrants*. Could this account for the following discrepancy in the two student groups' attitudes to the physical access to ICTs on the WSOE campus?

	Access to computers on campus is never available	**Access to computers on campus is difficult**	**Access to computers on campus is occasionally a problem**	**Access to computers on campus is never a problem**
In-service students	**42** 31% (32)	**78** 57% (4)	**15** 11% (14)	**1** 1% (17)
Pre-service students	**27** 7% (11)	**159** 41% (2)	**132** 34% (5)	**70** 18% (6)
Total	14%	46%	28%	12%

Table 3: First year B Ed students' experience of access to ICTs on the Wits School of Education campus. Actual student responses have been indicated in bold. Expected frequencies have been indicated in parentheses. The percentage of the response across the whole research sample has also been provided.

When asked how they experienced access to the computer labs on the WSOE campus there was a resounding overall 46% response that the access is difficult due to the shortage of ICTs, students spending a lot of time playing games on the computers while others are waiting in a long queue to use the computer. The actual responses of the pre-service group in particular differ significantly from the expected responses – the anticipated results / responses have been indicated in parentheses in the table above. While only two pre-service students were expected to imply that access was difficult, a resounding 159 indicated that access to ICTs on the WSOE campus is a problem. A Chi-Square test was conducted in order to investigate whether the frequency

counts are distributed identically across the two different populations, namely the group of pre-service students and the group of in-service students. An alternative hypothesis that a difference in access to ICTS on campus is experienced by the two groups has been suggested in opposition to the null hypothesis of there being no difference in the physical access experienced, i.e. both groups experience access to ICTs on campus equally. In the event of the frequency counts not being identical, an investigation has been conducted into the extent to which these counts differ. (Chi-square: 90.91; DF:3; p-value<0.05)[36] confirms that there is a significant difference between the data sets that cannot be due to chance alone and the above stated null hypothesis is rejected.

While 31% of the older in-service students indicated that access to ICTs on the WSOE campus is never available, 57% said access was difficult. In contrast to the younger pre-service group of whom 7% said access was never available and 41% said it was difficult. The older in-service group of students mentioned the problem of not having ICT facilities in the Stay City residence where they are staying and if they want to use a computer on campus they will have to stay late and this has transport and security consequences. Facer (2002) and Selwyn (1998) in Gudmundsdottir (2008) point out the significance of home computers and how access at home supports learners digital competence. These concerns are voiced in the comments detailed below:

- "*Because the computer isn't mine. I have to use it after waiting in the queue for long*" (41 year old in-service student)
- *"The long wait at computer lab and the exorbitant charges at internet cafes"* (44 year old pre-service student)
- *"I do not have my own computer and the computer lab is always full"* (18 year old pre-service student)

[36] Calculations provided in Appendix D

It is evident that access to ICTs on the WSOE campus is a problem that needs to be addressed. The older in-service group of students experience this problem of physical access more keenly than the pre-service group. While the older in-service group cite access to ICTs as a main problem whereas the younger group emphasise the importance of previous knowledge and skills. This group of students is more likely to have access to ICTs in the schooling whereas the older group who matriculated on average more than 20 years ago may not have. Also coming from Limpopo province where there is not an initiative such as Gauteng-On-Line or the Khanya Project in the Western Cape, the schools that they teach in may also not have ICTs. Access on the Wits Education campus is also a contentious issue. There is one 24 hour open access lab of 30 computers serving more than 700 first year students alone. Plans and initiatives are in the pipe line to build a 100 seater open access lab in the near future but for the meantime, to the students it is an accepted fact that access is difficult on campus.

Numerous angry comments to this lack of access were made and include:

- *"Computer lab is always full, other students are playing cards on them."* (45 year old in-service student)
- *"Computer lab is always full with long queues waiting for a chance to grab one computer"* (41 year old in-service student)

Why is the older in-service group finding it harder to access ICTs in the computer lab than the younger students? Do the younger students have computers at home therefore not so stressed about access ICTs on campus? A resounding 93% of the older in-service students compared to 49% of the Pre-service students do not have access to computers at home. This may be why the pre-service group do not feel access to ICTs on campus is as big a problem as the in-service groups and do not list it as one of the important barriers that they face when accessing ICTs. One of the reasons is that the in-service group of students are staying in a residence off campus called

'Stay City' and there are no ICT facilities there. This is not to say that if they were at home in Limpopo their access to ICTs in their own homes may be better.

Technical Problems such as slow Internet connections, computers that are slow and freeze regularly, power cuts and load shedding as well as viruses are faced by 15% of the younger pre-service group of students. Mention was also made of updated software being unfamiliar when the students are comfortable with the older version. Tying such a barrier as identified by the students within the literature has proven troublesome. Initially I likened it to a digital barrier but after thought have decided it is a physical barrier which defined by The E-Divide team as being a lack of access to actual computer hardware and the Internet, can be further developed to include access to *properly functioning* computer hardware. In deepening our understanding in this regard, the following comments are provided. Note that no in-service students identified this as a barrier therefore they are not represented in the comments below:

- "*When the computer takes time to log in"* (18 year old pre-service student)
- "*A computer which is programmed differently than the one I am used to using"* (22 year old pre-service student)
- "*New versions of Word"* (20 year old pre-service student)
- "*Power cuts"* (18 year old pre-service student)
- "*When it freezes all the time"* (20 year old pre-service student)
- "*When a computer has a virus and takes long to open a certain program"* (19 year old pre-service student)

Even though **poor typing skills** could be categorized with lack of skills – (a digital barrier), there was such a high incidence of this being commented on that it has been included as its own barrier. 2% of in-service students and 11% of pre-service students made mention of this barrier.

It is disturbing to think that the students feel that they are unable to use ICTs effectively as they do not have good typing skills and cannot "touch type". It can be difficult to find ones way around the keyboard if one has never learned to type and if ones eyesight is poor. As this is the main input device that the students are faced with when they sit down at the computer, not knowing how to use it effectively may seem like a great barrier to them.

Comments in this area include:

- "*Unable to type fast"* (32 year old in-service student)
- "*People staring and my slow typing skills"* (19 year old pre-service student)
- "*Typing slowly and not knowing where to go for certain things"* (18 year old pre-service student)

Interestingly **lack of assistance** was also quite prominent mentioned by 5% of the older in-service students and 4% of the pre-service student group. This included not receiving help from the lecturer, tutors or peers. The absence of a manual or notes was also raised. Later on aspects that make it easier for the students to use a computer effectively will be explored and this notion of help and assistance is once again raised. This is identified in the literature as a human barrier. The older group of student may be reticent to ask the younger students for assistance when accessing ICTs in the computer labs, while the younger students are working within a community of digitally literate peers. The students commented:

- "*When there is nobody to help me"* (36 year old in-service student)
- "*If I am alone and don't have something like a book"* (18 year old pre-service student)

One student said that **everything** makes it difficult for him to use ICTs while a larger percentage commented that there were **no barriers**. The experience of no barriers to the use of ICTs is an ideal hoped for in a tertiary course on ICTs, yet this seems disappointingly low for young

students (4.7%). None of the older in-service students indicated that they faced no barriers which is to be expected if we consider that they are characteristic of Prensky's "digital immigrants". It may be worth considering that the negative attitudes that the in-service students highlighted earlier in this chapter may be linked to the fact that none are freed of barriers when accessing ICTs in their studies. The following comments made by pre-service students are provided as a means to elucidate the above percentages.

- *"nothing"* (19 year old pre-service student)
- *"Don't experience much problems using a computer."* (18 year old pre-service student)

Noise – a physical barrier and a distracting environment making it difficult to concentrate were raised by a few pre-service (2%) students as affecting their effective use of computers

- *"Working in crowds, people making noise."* (39 year old pre-service student)

Some students have poor eyesight so **physical issues** such as these also need to be considered. Only 1% of the pre-service students commented on this aspect.

- *"I wear glasses and my eyes get tired very quickly"* (21 year old pre-service student)

As an approach that proposes multiple causal agents operate as generative mechanisms is assumed, consideration must be given as to whether the lack of skills barrier identified by both groups of students could be impacted on by other issues such as age, socioeconomics, gender or language for example. As mentioned previously these assumed barriers impact on each other and are seldom able to be viewed in isolation. An exploration into the possible underlying factors that may result in a student not possessing these ICT skills follows. Firstly the student may lack ICT skills because he or she did not receive any prior training on ICTs due to a myriad of possible reasons, such as ***gender*** – a girl's education may not be promoted in the students family

or *culture*. There may not have been a competent ICT instructor (*human*) available at the institution where the student studied previously. The student may come from a rural area *(locality)* where there is no electricity and therefore no access to ICTs. A classroom environment may bring back painful memories of schooldays or of past failures as well as the older person assuming that they are too old to learn *(age)*. This assumption may also be reinforced by those around them. *Socio-economically* the cost of computers is also inhibiting. The student may have poor eyesight (*physical)* which may have prevented the student from previous ICT usage and therefore the opportunity to develop the skills. The computer that the student was working on could also have been technically unsound – slow or repeatedly freezing, resulting in the student becoming frustrated and abandoning the task. Although English is widely regarded as the adopted language of ICTs, the student may have experienced difficulty in working on computer software that was not available in his or her home language.

Race is a contentious issue and needs to be explored as the average matriculation year of in-service students is 1989. The first democratic election was only held in 1994 which means that these students studied under Apartheid education and may have been denied the benefits of modern technology.

Student comments furthering the above exploration are as follows:

- *"I never used a computer in my life. Where I come from there is no electricity so we don't have access to any electrical appliance"* (18 year old pre-service student)
- *"I have no experience because my place is a remote rural area which is underdeveloped, no electricity at all"* (41 year old in-service student)
- *"I've never used a computer. I'm from a very remote area without electricity. I only see computers in the shops recently here at Wits"* (unknown age in-service student)

From the brief scenario and comments above the researcher hopes to have illustrated that a number of factors or possible barriers come into play which may inform the reader as to why a

student may not possess the required previous skill in ICT usage that will better assist him or her in accessing ICTs on the WSOE campus.

For this reason it is important to remain aware that things may not appear as simple as they seem and the constant mixing of possible barriers in a students past experience play an important role in their current experience.

The students are clearly divided along lines of age. For this reason I hope to highlight some aspects in addition to the above mentioned ones that may be unique to the older students' experiences. Many older people may not know what ICTs can do as they have not had any *previous experience* of one. Bearing in mind that a computer is only a tool and a tool has to be used for something, should the student never used it before, they may not be aware of its possibilities.

- *"I never use computer in my class so I am not sure on how important are they in the classroom"* (42 year old in-service student)

It follows that the older students may not see the value in acquiring ICT skills as they have not used ICTs in the past. From the comments provided it can be assumed that the older students may lack a *peer group* who can provide them with the support they need. The younger students may be unwilling to help older students or are impatient with them. Older students enter this community of practice in which, interestingly, the older students are the novices and the younger students are the masters.

The older group of students have commented on the *instruction* they receive by saying that:

- *"Lecturers are too fast. We don't catch up"* (39 year old in-service student)
- *"The lecturer who is teaching us is not available and he teaches us as if we are computer literate"* (39 year old in-service student)

It would appear that instructors are inclined to go too fast for older students, assuming that they will 'catch on' as quickly as younger students.

5.5. Aspects that make it easy to use ICTs effectively:

Having looked at possible barriers that the students may face when accessing ICTs on the WSOE campus it is interesting to identify what aspects the students feel promotes their effective use of ICTs.

	Skills (Previous knowledge and training)	**Help** (From peers, notes and onscreen help)	**Access** (Availability of computers to practice on in labs and owning own computer at home)	**Technology** (The software programs themselves and fast internet connection. Hardware – fast computers that do not have any problems)	**Quiet Environment**	**Interest** (Enjoying using and knowing the importance of being able to use it)	**Typing** (Having good typing skills)	**Nothing**
In-service students	**57** 42% (68)	**39** 29% (27)	**28** 20% (20)	**1** 1% (5)	**0** 0% (4)	**1** 1% (2)	**0** 0% (2)	**10** 7% (8)
Pre-service students	**206** 53% (263)	**66** 17% (78)	**50** 13% (58)	**19** 5% (15)	**16** 4% (12)	**6** 1.5% (5)	**6** 1.5% (4)	**19** 5% (21)
Total	51%	20%	15%	4%	2.5%	1.5%	1%	5%

Table 4: Elements that promote access to ICTs as identified by first year B Ed student. Actual student responses have been indicated in bold. Expected frequencies have been indicated in parantheses. The percentage of the response across the whole research sample has also been provided.

Once again previous skills and experience in the use of ICTs as well as physical access to a computer are noted by the majority of the students. Both groups of students indicate that their

prior knowledge of ICTs is important in helping them use ICTs effectively. Assistance in the form of peers, a tutor or a manual / course notes have also been indicated by 19% of the students as assisting them in their effective use of ICTs. Technical issues such as the smooth running of the computer hardware, fast Internet connection and relevant software programs are also mentioned as helping the students.

The Chi-Square test was conducted in order to investigate whether the frequency counts are distributed identically across the two different populations, namely the group of pre-service students and the group of in-service students. An alternative hypothesis that the two groups experience different factors that promote their use of ICTS on campus has been established in opposition to the null hypothesis of there being no difference in the promoters to usage and access, i.e. both groups experience exactly the same aspects that promote their usage of ICTs. In the event of the frequency counts not being identical, an investigation has been conducted into the extent to which these counts differ. (Chi-square: 27.19; DF: 7; p-value <0.05)[37] confirms that there is a significant difference between the data sets that cannot be due to chance alone and the null hypothesis is rejected. Thus a conclusion that may be drawn that the in-service group of students experience different aspects that promote their usage of ICTs than the pre-service students. On closer inspection of the anticipated responses (indicated in parantheses) it is evident that in this indicator on the questionnaire, the student responses are more closely aligned with what was expected than the previous table in which the students indicated the barriers they faced when accessing ICTs.

Once again the influence of working in a quiet environment is raised. Interestingly while 8% of the students indicated that their lack of typing skills hindered their effective use of ICTs, only 1% of the students mention possessing good typing skills as possibly assisting them in their ICT usage. An interest in, enjoyment of and knowledge of the value of using ICTs is acknowledged

[37] Calculations provided in Appendix D

by a few students in both the pre-service and in-service group. Again some students point out that there is 'nothing' that can help make it easier for them to use ICTs effectively.

Similarly to the barriers, **skills** implies previous knowledge and working with ICTs. Having prior knowledge and experience in the use of ICTs is seen to aid one's current usage as can be concluded from the comments below.

- "*Understanding the process of working it*" (39 year old in-service student)
- "*Previous knowledge and self exploration*" (18 year old pre-service student)

Help is seen as the assistance the student may receive from a peer, the lecturer or tutor or even from the manual that he or she is issued with in the formal ICT instruction class. It also includes the online help facility that software programs offer. Having someone close at hand when the older in-service student gets stuck would appear to be a strong aid to effectively using ICTs as 29% of these students value this assistance.

- "*Having someone next to me to ask if I encounter problems so that I do not lose files*" (39 year old in-service student)
- "*Manual that gives me instructions and procedures to follow*" (33 year old in-service student)
- "*Little icons that keep on appearing when you click the mouse*" (22 year old pre-service student)

Previously 68% of the older in-service students cited **access** to ICTs on the WSOE campus as posing a barrier to their effective use of ICTs, only 20% now mention that this is aided by access to computer labs on campus. They do however now state that skills (42%) and help from others

(29%) are important in assisting them to effectively use ICTs. The comments made were to the following effect:

- *"I have my own laptop"* (20 year old pre-service student)

Technology is the smooth running of the computer hardware and programs – no technical hitches such as virus, sticky mice etc are encountered. In total 4% of the research population indicated that these factors improved their experience of using ICTs. The following two comments provide some insight into this factor:

- *"When the keyboard and mouse are working well, as well as when all the necessary programs are installed"* (18 year old pre-service student)
- "*When its functioning without problems"* (20 year old pre-service student)

A **quiet environment** was raised by 4% of the pre-service students (no in-service students) implying that a lab without noise is conducive to using ICTs effectively.

- *"Being able to attend the computer not in a very crowdy place so I can correct my mistakes with no fear of being laughed at"* (20 year old pre-service student)
- *"Environment, in the comfort of my home without pressure"* (20 year old pre-service student)

An **interest** in ICTs and a willingness to learn was mentioned by 1% of the in-service students and 1.5% of the pre-service students. This was an unanticipated factor and is clarified by the following comments:

"I am willing to know better on the technological world" (26 year old pre-service student)

- *"It is fun and I understand it"* (18 year old pre-service student)

Possessing good **typing skills** is once again raised. 1.5% of the pre-service students, yet none of the in-service students indicated that being able to type promoted their interaction with ICTs

- "*I have good typing skills*" (19 year old pre-service student)

There were some students who commented that there is **nothing** that makes it easy for them to effectively use ICTs. The following comments expound on the frustration that some students encounter:

- *"There is nothing that makes it easy to access"* (40 year old in-service student)
- *"It is never easy"* (20 year old pre-service student)

It could be concluded that the older in-service group of students feel that their effective use of ICTs is hindered predominantly by their lack of access to the physical resource on campus, yet when they are working on a computer, the previous skills that they possess and the assistance they receive from their peers, the tutor or even the manual promote this effective use. The younger group of pre-service students detail a lack of skill and previous knowledge as being both a barrier (49%) and help (53%) to their effective use of ICTs. This skill and what exactly the students understand it to be could be researched in further studies as the term "Computer Literacy" is raised 84 times (16% of students) in the questionnaires with comments regarding knowing computer basics made by 18 students. Broad sweeping statements such as "No one is not Computer Literate these days" (33 year old pre-service student) and "*Everything needs a computer and if you don't know a computer you are stupid*" (18 year old pre-service student) were made.

5.6. The language barrier?

One of the research questions posed is whether the students' home language poses a barrier to their effective use of ICTs on the WSOE campus. Although none of the students indicated that language was a barrier in the previous tables, the findings should not be ignored in light of the previous literature reviewed. By removing the language barrier the computer, and the information it provides access to, becomes accessible (Bailey translate.org.za).

The following table illustrates the language demographics across the two groups:

11 official Home languages:

Language	% of pre-service students	% of in-service students	Total
Afrikaans	2 %		1.5 %
English	26 %		19 %
IsiXhosa	5 %		4 %
IsiZulu	27 %		20 %
SiSwati	6 %		4 %
IsiNdebele	0.5 %		0.4 %
Sesotho	9 %		7 %
Sepedi	9 %	66 %	24 %
Setswana	6 %		5 %
Tshivenda	2 %	9 %	4 %
Xitsonga	6 %	21 %	10 %

Table 5: Language distribution of the first year B Ed students (11 official languages)

Other languages:

Language	% of pre-service students	% of in-service students	Total
Chinese	0.2 %		0.2 %
Hebrew	0.2 %		0.2 %
Portuguese	0.5 %		0.3 %
N Sotho	1.5 %		4 %

Table 6: Language distribution of the first year B Ed students (Additional languages to the 11 official languages)

The predominant home language of the older in-service group of students is Sepedi with only 19% of the total number of students having English as their home language. As a result difficulties may be experienced when accessing computer applications which are for the most

part only available in English. This is another barrier that cannot be ignored and illustrates another strata in the multi-faceted causal agents operating as generative mechanisms approach.

5.7. Novices:

At the beginning of this study, one of the questions I posed was to what extent the older in-service students can be considered to be novice ICT users. A group of novice ICT users emerged during the data analysis who were identified by their description of their previous and current ICT usage. Interestingly 73% of the older in-service students could be deemed novice ICT users while only 22% of the younger pre-service group. Overall 35% of all the first year students surveyed were found to be novice ICT users / first time ICT users. Many students commented that this was the first time that they were ever using ICTs. The older group of in-service students had a higher percentage of novices compared to younger group and it is possible that for this reason they do not experience positive feelings when accessing ICTs and may also experience more barriers than experienced ICT users. I re-examined the data obtained from only a novice ICT user's perspective and the following comments were made by novice ICT users on what made it easy for them to use ICTs.

	Skills (Previous knowledge and training)	**Help** (From peers, notes and onscreen help)	**Access** (Availability of computers to practice on in labs and owning own computer at home)	**Technology** (The software programs themselves and fast internet connection. Hardware – fast computers that do not have any problems)	**Quiet Environment**	**Interest** (Enjoying using and knowing the importance of being able to use it)	**Typing** (Having good typing skills)	**Nothing**
Novice students	42%	26%	13%	5%	1%	1%	2%	10%

Table 7: Elements that promote access to ICTs as identified by novice students

The novices' comments on what makes it difficult to use ICTs are detailed below.

	Lack of Skill (Lack of knowledge and previous training)	**Technical Problems** (Internet slow, hangs, do not have connectivity, computer crashes. Power-cuts, new versions of software programs, viruses)	**Lack of Access** (Computer labs full & not owning own computer)	**Typing** (Not being able to type quickly or properly)	**Lack of Assistance** (No help from lecturer or peers. Lack of a manual)	**Noise** (Other students making a noise in the lab)	**Physical Issues** (Poor eyesight)	**Everything**	**Nothing**
Novice students	56%	3%	22%	5%	11%	1%	1%	-	1%

Table 8: Barriers to accessing ICTs as identified by novice students

Interesting to note is that in contrast to the older in-service group of students who feel lack of physical access to computers is a barrier in their effective use of ICTs, the novice group of students focus more on skills and previous knowledge (56%), yet the majority of the in-service students are in fact novice ICT users. In continuity with the other two groups, in-service and pre-

service groups, the novice group also see this prior knowledge and skills as assisting them to using ICTs better. 61% of the older in-service group of students indicated that during the first couple of weeks of lectures this year[38] they had to submit typed assignments for three or more courses. This is concerning when it is apparent that the majority of these students are novice / first time ICT users who are battling with access to ICTs on the Education WSOE campus. These students have the added disadvantage of staying in a residence where they once again do not have access to ICTs.

5.8. Importance of ICTs in teaching and learning:

	Very important	Important	Not very important	Not used at all
In-service group	**90** 66% (88)	**15** 10.5% (32)	**1** 1% (7)	**30** 22.5% (9)
Pre-service group	**248** 64% (250)	**109** 28% (92)	**27** 7% (21)	**4** 1% (25)
Total	64%	23%	6%	7%

Table 9: B Ed students perceptions of the importance of ICTs in teaching and learning
Actual student responses have been indicated in bold. Expected frequencies have been indicated in parantheses. The percentage of the response across the whole research sample has also been provided.

It would appear that both groups felt that computers and their applications had an important role to play in teaching and learning, as well as assisting them in aspects of their teaching career.

[38] 2009

A Chi-Square test was conducted in order to investigate whether the frequency counts are distributed identically across the two different populations, namely the group of pre-service students and the group of in-service students. An alternative hypothesis that there is a difference in perceptions on the importance of ICTS by the two groups has been suggested in opposition to the null hypothesis of there being no difference. In the event of the frequency counts not being identical, an investigation has been conducted into the extent to which these counts differ. (Chi-square:88.41; DF:3; p-value<0.05)[39] confirms that there is a significant difference between the data sets that cannot be due to chance alone and the above stated null hypothesis is rejected.

When asked how important ICTs were in teaching and learning it was expected that the older group of in-service students would not realize the importance of ICTs in teaching as they had not had exposure to them previously and as a result may not have realized the possibilities or benefits ICTs may provide, - following the notion of "we don't miss what we don't have". Yet, although the older in-service group is made up of predominantly novice ICT users, they did seem to realize the potential for ICT usage in their classrooms as is evident in the comments made by in-service students that follow:

- *"Technology is highly a pre-requisite measure in this era. Lots of things need computer literacy"* (39 year old in-service student)
- *"We must be supplied with computer because it makes the teaching more effective"* (38 year old in-service student)
- "*I have never used it* (computer) *but I regard it as important as the world has developed and depends much on technology"* (40 year old in-service student)

[39] Calculations provided in Appendix D

- *"If you apply for promotional posts they need computer literate people. The government has introduced the method of using internets* (e-mails?) *to communicate with schools"* (35 year old in-service student)
- *"It will help me in my teaching career because I will be able to acquire information, store it and access it when necessary"* (39 year old in-service student)

All the students went on to highlight some of the benefits of using ICTs in their teaching, mentioning that ICTs could help with researching for information and resources for lessons using the Internet. Assisting with administration work such as classlists, reports and registers. Enhancing learning and delivering neatly presented lesson plans and worksheets. A time saving function in that they would be able to work faster and neater as well as storing documents for quick and easy retrieval. Communication with parents and other teachers could also be promoted through the use of ICTs.

Interestingly 23% of the older in-service students said that ICTs were not used at all in teaching. This may refer to their current experience in the schools where they taught as a comment made in this regard was:

- *"As an experienced teacher of 20 years, I have never used a computer in my teaching"* (43 year old in-service student)

The following comments made by younger pre-service students highlight their views on the importance of ICTs in their teaching:

- *"You need to be able to use a computer so that you won't be lost with the new technology and it will make your life and work easier for you"* (18 year old pre-service student)

- *"A computer is a great resource but if not used effectively, can be a hindrance. It is important to be skilled in order for them to help and enhance teaching"* (18 year old pre-service student)

There would appear to be an awareness that ICTs are becoming or have become an ubiquitous feature of everyday life. It is a widely stated assertion that ICTs are intrinsically attractive to people from all backgrounds and walks of life. (Rogers, 2003). This would appear to be representative of the above statistical analysis. 64% of the students in this study acknowledge the importance of ICTs in their lives, in their studies and their teaching careers.

Chapter 5: Conclusion

It is evident through an analysis of the data that two very different groups of students are working with ICTs at the 'entry level' in the undergraduate teacher education programme at Wits – a group of young pre-service students who matriculated one year ago and are on average 19 years old and an older in-service group of teachers who matriculated 20 years ago and are of the average age of 39 years.

The students are divided into these two groups along the line of age. The younger group could be seen to be examples of 'digital natives' – having grown up immersed in technology, while the older group of students could be seen to be 'digital immigrants' – newcomers to a world of technology. It seems irresponsible to be of the opinion that the divide between the two is minor and will stabilise of its own accord within time. From the findings of this study it is evident that these two groups of students experience ICTs differently. The younger pre-service group experience the use of ICTs far more 'positively' than the older in-service group. As a result one could assume that the approach one would use to teach them would and should be different.

Three barriers to the use of ICTs on the WSOE campus were identified in this study. The first one being a lack of skill and expertise in using ICTs. Possibly defined further as a lack of the 'computer basics' or not being computer literate, this barrier was felt more keenly by the younger pre-service students than by the older in-service students. The latter citing lack of physical access to ICTs on campus either due to the computer labs being full or lack of possession of ones own computer as being the main barrier they face when accessing ICTs. Thirdly, both groups mentioned that lack of help and assistance from either peers or tutors, as well as not being in the possession of some form of reference material or a course manual hindered their successful ICT usage.

At the onset of this study a possible twelve barriers were identified through an exploration of the relevant literature. As detailed above, the first year B Ed students predominantly experience two of these, one being a lack of physical access to the computer hardware and the second being a lack of access to human resources, such as peer assistance, tutor help. The third barrier, not detailed in the literature, is a lack of skills, which may result from any of the above inter-related barriers. These barriers need to be viewed in the light of impacting on each other, with one or two resulting in an experience of a third. A student may lack ICT skills which may act as a barrier to his or her physical access to ICTs. This lack of skill may be the result of the student coming from poor socio-economic background in which he or she did firstly not have access to properly functioning computers or secondly to adequate human resources such as a skilled teacher. In addition to this the student may come from a rural area and speak a language other than English. These factors further impacting on the students present day experience of ICTs on the WSOE campus.

What I hope to elucidate here is that there is a mechanism of these possible barriers as identified in the literature and by the students in this study, whereby they impact on each other and ultimately impact on the students' experiences with ICTs. By looking below the surface of the older in-service students being 'computer illiterate' and struggling with their first year ICT skills course, contributing factors can be better identified and possibly resolved in order to provide a more successful course and tuition.

Firstly physical access to the computers in the labs is an issue that needs to be addressed on the WSOE campus. It is not acceptable that students are not able to access ICTs on which to complete assignments and practice their newly acquired skills. The specific needs of these

students need to be heard. The WSOE is in the process of building a new ICT facility but it needs to be investigated whether this is adequate to fulfill the demand for access.

Ms Naledi Pandor's[40] foreword in the white paper on e-education (2004) concerning her vision for ICTs is interesting to note here:

> Our world is changing, and information and communication technology (ICT) is central to this change. Digital media has revolutionised the information society. These advances in ICT have dramatically changed the learning and teaching process, and have expanded new learning opportunities and access to educational resources beyond those traditionally available.
>
> The provision of a telecommunication infrastructure available for learning and teaching is gradually increasing, and many schools are exploiting the benefits of ICT to enhance the quality of teaching. The introduction of ICT to our schools will create new possibilities for learners and teachers to engage in new ways of information selection, gathering, sorting and analysis. In addition, ICT has the potential to enhance the management and administrative capacity of schools.
>
> We want to ensure that every school has access to a wide choice of diverse, high quality communication services. We want all learners and local communities to benefit from this investment. The services provided by the initiative will enhance lifelong learning and provide unlimited opportunities for personal growth and development to all. (page 3)[41]

ICTs are the future – the students realize this and it is highlighted above in the Education Minister's statement. For this reason it is obvious that the B Ed students – the future teachers need to be skilled in the effective use of ICTs as well as being digitally literate.

One of the Western Cape Education Department's (WCED) plans for the use of ICT in schools is to "empower learners to join the global knowledge community"[42] among others. This cannot be achieved when the majority of teachers themselves are novice ICT users. The aim of the WCED Khanya project is to improve learners as well as educators' possibilities to use modern technology and to correct some of the injustices of the past and to gain better access to

[40] Minister of Education, South Africa 2004-2008
[41] Available at http://www.info.gov.za/view/DownloadFileAction?id=68777

[42] Available at http://wced.wcape.gov.za/home/projects/school_it.html

knowledge and information. Yet, despite extensive training, teachers are still not well equipped to use the technology for its intended purpose. As one of the main aims of the Khanya initiative is to diminish the digital divide by enabling every learner and teacher access to the technology, it is necessary to reflect on the role of teachers. Therefore, if the teachers are not confident in using the technology, how can learners be expected to take full advantage of the available technology? Teachers need practice and time to try out things and to increase their ICT competence. If they do not use ICTs on a regular basis they do not feel comfortable enough experimenting with their learners (Gudmundsdottir, 2008). There are a number of novice ICT users in the group studied. This needs to be addressed in order to ensure that these teachers are fully equipped with the necessary ICT skills in order to implement the educational initiatives objectives as mentioned above as well as to explore the learning opportunities stated by the then South African Minister of Education.

Then President Thabo Mbeki highlighted the importance of ICTs on a national level at an imbizo in 2001 stating that "we must continue the fight for liberation against poverty, against under-development, against marginalization" and " …information and communication technology is a critically important tool in that struggle" (Mbeki, 2001). By highlighting the importance of ICTs for social and economic development in South Africa he supports an initiative to ensure that ICT access and skills do not exacerbate the already great inequities in education. The students in this study realize the importance of ICTs in education and in their future careers. This acknowledgement of the benefit of ICTs in teaching and learning will help motivate the students to acquire the much needed ICT skills that they are lacking.

Returning to the original research question which investigated whether the first year B Ed students on the WSOE campus experience certain barriers when accessing ICTs, it can be

concluded that such obstacles do in fact exist. These being predominantly those of lack of previous skills, lack of assistance as well as a lack of physical access to actual computers. There is a difference in the ICT experience between the younger pre-service group of students and the older in-service group of students with the younger group feeling more positive when using ICTs. However it is apparent that the two groups both experience similar barriers but to varying degrees.

In order to ensure that any inequalities are diminished as quickly as possible, these future teachers need to be adequately trained. Physical issues of access to ICTs, broadening of their skills base as well as ensuring the students receive the help and support they need will help resolve some of the barriers that first year students face when accessing ICTs on the WSOE campus. The assumption that once access is improved, effective use will improve needs to be challenged. Physical access is only one of the challenges that students face. Other challenging aspects such as the age of the student, previous skills, language need to be focused on. The promotion of a positive attitude towards the use of ICTs as well as highlighting the importance and possible uses of ICTs in education can go a long way to furthering the demise of one of the divides that exists in the use of ICTs. Through an awareness of these barriers, WSOE is in a position to improve the first year B Ed students experience with ICTs to ensure that they themselves and the future generations they teach benefit.

How exactly can a student's experience with ICTs on the WSOE campus be enhanced? Through an analysis of the data, certain barriers as discussed above were identified. Some of these are actual real barriers while others may be more subjective or perceived barriers. Whether they are actual or real, they would still need to be addressed in order to ensure that the student overcomes them.

The first barrier identified was that of previous skill. A large group of the students have not had previous experience with ICTs. As a result, further investigation needs to be made into the possibility of teaching the two groups, novice ICT users and experienced users, separately. This raises the debate of the disadvantages of 'streaming' learners and them not having a more experienced peer group within the class to ask for assistance. I would be reluctant to alter the curriculum for these students, rather investigate means in which the same curriculum could be delivered at a slower pace with more opportunity for practice and reinforcement of learned skills. The option of a "bridging course" or beginner's course to bring the novice ICT users up to the required standard could be a prospect, as are "extra lessons".

The second barrier of access has been addressed with the opening of a 100 seater, 24 hour, seven days a week, open access computer lab with printing and internet facilities. At the same time technological issues such as slow computers have been addressed by the opening of this new lab. The barrier of not being able to type quickly and accurately on the keyboard can be easily resolved by pointing the students in the direction of an online typing tutorial which they can use at their own convenience. It is possible to build a two week typing tutorial section into the course material to ensure that the students become familiar with the keyboard and overcome this barrier. With regards assistance, the new lab is manned form 08:00 to 17:00 by two student helpers. While these helpers may not be able to assist with complex issues, they can definitely provide assistance with technical problems as well as routine difficulties, for example how to print, save a document, etc.

As this study has been able to elucidate barriers that this group of first year B Ed students face when accessing ICTs on the WSOE campus, it is possible to apply these findings to better structure course material and the students' engagement with ICTs on campus in the future.

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Appendix A

WITS Student Computer Survey 2009

Age

Gender

Male	Female

White	Black	Coloured	Indian	Asian

Year of study

1	2	3	4

Are you repeating 1st year?

Yes	No

Home language

Home province / country

What year did you matriculate?

Which school did you matriculate from?

Highest qualification

				other
Matric	HDE	B Ed	B Prim Ed	

Are you a member of the Limpopo teacher group that has come to Wits this year?

Yes	No

Do you have access to a computer at home or in the Residence you are staying in?

Yes	No

Do you have access to the Internet at home or in the Residence you are staying in?

Yes	No

How often do you use the computer at home or in Residence?

Daily	Weekly	Monthly	Never

How often do you use the computers here on the WITS School of Education campus?

Daily	Weekly	Monthly	Never

Describe your previous experience with computers

_____

_____

_____

Describe your current experience with computers

_____

_____

_____

Which programs have you heard of?

Word	Excel	Powerpoint	Access	FrontPage
Publisher	Explorer	Visual Basic		

Which programs are you familiar with and would describe yourself as being competent working with?

Word	Excel	Powerpoint	Access	FrontPage
Publisher	Explorer	Visual Basic		

Within the last 3 months have you done any of the following.
Please tick all that are applicable:

	Used a Web browser (e.g. Explorer)
	Sent an email message
	Used a database (e.g. Access)
	Used a spreadsheet (e.g. Excel)
	Played a game on the computer
	Used the library software for books or journals
	Used a desktop publishing program
	Used a word processor (e.g. Word)
	Taken an online course
	Accessed social networking sites (e.g. Facebook)
	Made a presentation (e.g. Powerpoint)

How many courses (this year so far) have required you to use a computer for at least one assignment? ☐

How would you describe your access to computers on campus?

Never a problem	Occasionally a problem	Access is difficult	Access is never available

Comment on the above

_____

_____

Would you like training on …… other

Internet searching	Presentations (Powerpoint)	Word processing (Word)	Spreadsheets (Excel)	Databases (Access)	

Do you have an email address?

Yes	No

One word to describe how you feel when working on computer

☐

What makes it easy for you to use / access a computer effectively?

_____

_____

What makes it difficult for you to use a computer effectively?

_____

_____

How important are computers in your teaching and the classroom?

Very important	Important	Not very important	Not used at all

Comment on the above

How important is being skilled in using a computer and its applications in your teaching career?

Very important	Important	Not very important	Not used at all

Comment on the above

Claudette Muller 9101080H Research Project

Appendix B

State sends teachers back to school

PIET RAMPEDI

THE Limpopo education department has taken an unusual step in a bid to improve the future standard of education in the province.

It has withdrawn 322 teachers on full pay and sent them on a four-year government funded specialised training programme at the universities of the Witwatersrand and KwaZulu-Natal – to the tune of R33 million.

Education MEC Aaron Motsoaledi said the initiative came after an evaluation of Grade 3 learners over the past few years showed a lack of teaching skills at the foundation phase. This phase is critical and covers grades one to three.

He said the future of foundation phase learners in Limpopo remained in the hands of underqualified teachers with few skills and this resulted in learners being more vulnerable, Motsoaledi said.

"The learners can easily be destroyed if you put poorly qualified teachers before them. They absorb everything and they can be made to like or dislike books," he said.

As part of a contract signed with the department, the teachers have to work in Limpopo public schools for five years once they qualify, or refund the department for all expenses incurred.

Motsoaledi said the programme would continue for the next decade with at least 100 bursaries offered yearly.

Mary Metcalfe, the director of Wits University School of Education, said the curriculum for the four-year foundation phase degree included academic and professional components. Among others, students were taught the methodology of teaching foundation phase, especially numeracy and literacy.

Metcalfe said the new intakes would also spend six weeks every year in township and former model C schools to garner different experiences.

She blamed the shortage of foundation-phase teachers for South Africa's declining education standard.

The downward spiral in matric results has culminated in the national pass rate dropping to 62.5% last year.

"Foundation phase is the basis for excellence and the basis for the future," Metcalfe insisted.

Metcalfe added that Limpopo's long-term investment was necessary because there was no "quick fix" for the problem.

Molatelo Mothiba from Ga-Matlala near Mokopane, a foundation-phase teacher since 1994, said she was ready for the new challenge.

"I am excited. I will come back well-equipped because I have been trying to teach foundation phase without success due to my limited knowledge," she said.

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Wits School of Education

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STUDENT NUMBER: 9101080H

Protocol: 2009ECE50
29 July 2009

Ms. Claudette Muller
P O Box 1592
SUNNINGHILL
2157

Dear Ms. Muller

Application for Ethics Clearance: Master of Education

I have pleasure of advising you that the Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate has agreed to approve your application for ethics clearance submitted for your proposal entitled:

Barriers of accessibility and age as experienced by WITS first year B. Ed students when accessing computers and ICT's.

Recommendation:
Ethics clearance is granted

Yours sincerely

Matsie Mabeta
Wits School of Education
Cc Prof. I Moll (Supervisor)

Appendix D

Chi Square test for Barriers as indicated in table on page 53

		lack of skill	lack of access	technical	typing	assistance	noise	physical	everything	nothing	total
Experimental	Inservice	34 (9.90)	92 (82.50)	0 (15.02)	3 (6.69)	7 (0.18)	0 (2.08)	0 (1.04)	0 (0.26)	0 (4.67)	136
Control	Preservice	190 (3.51)	50 (28.92)	58 (5.27)	43 (2.35)	16 (0.06)	8 (0.73)	4 (0.36)	1 (0.09)	18 (1.64)	388
	total	224	142	58	46	23	8	4	1	18	524

The expected frequencies have been indicated in parantheses.

I have employed the Chi-Square test to validate this data. This test is applied to a single categorical variable from two different populations. The standard population group is the pre-service group of students, the experimental group is the older in-service group of students. I will investigate whether the frequency counts are distributed identically across different populations and if they are not, to what extent they differ.
I have asked both groups of students to identify aspects that they find hinder their use of and access to ICTs. Both groups of students have been asked the same question and I will use the Chi-Square test to determine whether the barriers experienced by the experimental group of in-service students differ significantly from the standard population group of pre-service students.

The data has been sampled from two populations and the categorical variable has 2 levels – either yes or no.

Problem:
Do the in-service group experience different barriers when attempting to access ICTs on the WSOE campus?

Null hypothesis – there is no difference in the barriers experienced by both groups. They both experience the same barriers
Alternative hypothesis – there is a difference in the barriers experience by the two groups.

Null hypothesis implies that there is no relationship between the row and column frequencies
I will use a 0.05 level of significance

Degree of freedom
Df=(r-1)*(c-1)
Where r is the number of populations in this study (2) , the group of pre-service students and where c is the number of levels for the categorical variables, in this case the barriers that the students indicated hindered their access to ICTs
Df =(2-1)*(9-1)
=1*8
Df =8

To determine the P value

$E_{r,c}=(nr*nc)/n$
E1.1 = (136x224)/524 = 58.13
E1.2 = (136x142)/524 = 36.85
E1.3 = (136x58)/524 = 15.05
E1.4 = (136x46)/524 = 11.94
E1.5 = (136x23)/524 = 5.97
E1.6 = (136x8)/524 = 2.08
E1.7 = (136x4)/524 = 1.04
E1.8 = (136x1)/524 = 0.26
E1.9 = (136x18)/524 = 4.67

E2.1 = (388x224)/524 = 165.86
E2.2 = (388x142)/524 = 105.15
E2.3 = (388x58)/524 = 42.95
E2.4 = (388x46)/524 = 34.06
E2.5 = (388x23)/524 = 17.03
E2.6 = (388x8)/524 = 5.92
E2.7 = (388x4)/524 = 2.96
E2.8 = (388x1)/524 = 0.74
E2.9 = (388x18)/524 = 13.33

$x^2 = \text{sum}[(O_{r,c} – E_{r,c})^2/E_{r,c}]$

$x^2 =$ $(34-58.13)^2/58.13 = 9.90$
$+ (92-36.85)^2/36.85 = 82.50$
$+ (0-15.05)^2/15.05 = 15.02$
$+ (3-11.94)^2/11.94 = 6.69$
$+ (7-5.97)^2/5.97 = 0.18$
$+ (0-2.08)^2/2.08 = 2.08$
$+ (0-1.04)^2/1.04 = 1.04$
$+ (0-0.26)^2/ 0.26 = 0.26$
$+ (0-4.67)^2/4.67 = 4.67$
$+ (190-165.86)^2/165.86 = 3.51$
$+ (50-105.15)^2/105.15 = 28.92$
$+ (58-42.95)^2/42.95 = 5.27$
$+ (43-34.06)^2/34.06 = 2.35$
$+ (16-17.03)^2/17.03 = 0.06$
$+ (8–5.92)^2/5.92 = 0.73$
$+ (4-2.96)^2/2.96 = 0.36$
$+ (1-0.74)^2/0.74 = 0.09$
$+ (18-13.33)^2/13.33 = 1.64$

$x^2 = 165.27$

The P value is the probability that a chi-square statistic having 8 degrees of freedom is more extreme than 165.27

Looking at the Chi-Square probability table
Df = 8
Predetermined level of significance 0.05
Level of significance is 15.507
x^2 is greater than this level of significance
165.27>15.507 therefore reject the null hypothesis. There is a significant difference between the data sets that cannot be due to chance alone.
Thus we conclude that there is a relationship between the barriers students face and whether they are in-service students or not. Ultimately it can be said that age impacts on the barriers that the students face as the in-service group of students is on average 20 years older than the pre-service group of students.

Chi Square test for Access as indicated in table on page 56

ACCESS		never available	difficult	occassionally	never a problem	Total
Experimental	Inservice	42 (32.40)	78 (4.42)	15 (14.04)	1 (16.47)	136
Control	Preservice	27 (11.35)	159 (1.54)	132 (4.92)	70 (5.77)	388
	total	69	237	147	71	524

Expected frequencies have been indicated in parantheses

I have employed the Chi-Square test to validate this data. This test is applied to a single categorical variable from two different populations. The standard population group is the pre-service group of students, The experimental group is the older in-service group of students. I will investigate whether the frequency counts are distributed identically across different populations and if they are not, to what extent they differ.
I have asked both groups of students to indicate whether they found access to ICTs on campus as being never available, difficult, occasionally a problem or never a problem. Both groups of students have been asked the same question and I will use the Chi-Square test to determine whether the barriers experienced by the experimental group of in-service students differ significantly from the standard population group of pre-service students.

The data has been sampled from two populations and the categorical variable has 4 levels.

Problem:
Do the in-service group find it more difficult to physically access ICTs on the WSOE campus?

Null hypothesis – there is no difference in the access to ICTs experienced by both groups.
Alternative hypothesis – there is a difference in the access to ICTs as experienced by the two groups.

Null hypothesis implies that there is no relationship between the row and column frequencies
I will use a 0.05 level of significance

Degree of freedom

Df=(r-1)*(c-1)
Where r is the number of populations in this study (2) , the group of pre-service students and where c is the number of levels for the categorical variables, in this case the barriers that the students indicated hindered their access to ICTs

Df =(2-1)*(4-1)
=1*3
Df =3

To determine the P value

Er,c=(nr*nc)/n
E1.1 = (136x69)/524 = 17.91
E1.2 = (136x237)/524 = 61.51
E1.3 = (136x147)/524 = 38.15
E1.4 = (136x71)/524 = 18.42

E2.1 = (388x69)/524 = 51.09
E2.2 = (388x237)/524 = 175.48
E2.3 = (388x147)/524 = 108.84
E2.4 = (388x71)/524 = 52.57

$x^2 = \text{sum}[(Or,c – Er,c)^2/Er,c]$

$x^2 =$ $(42-17.91)^2/17.91 = 32.40$
$+ (78-61.51)^2/61.51 = 4.42$
$+ (15-38.15)^2/38.15 = 14.04$
$+ (1-18.42)^2/18.42 = 16.47$

$+ (27-51.09)^2/51.09 = 11.35$
$+ (159-175.48)^2/175.48 = 1.54$
$+ (132-108.84)^2/108.84 = 4.92$
$+ (70-52.57)^2/ 52.57 = 5.77$

$x^2 = 90.91$

The P value is the probability that a chi-square statistic having 3 degrees of freedom is more extreme than 90.91

Looking at the Chi-Square probability table
Df = 3
Predetermined level of significance 0.05
Level of significance is 7.815
x^2 is greater than this level of significance

90.91>7.815 therefore reject the null hypothesis. There is a significant difference between the data sets that cannot be due to chance alone.
Thus we conclude that there is a relationship between the access to ICTs students face and whether they are in-service students or not. Ultimately it can be said that age impacts on the access to ICTs that the students face as the in-service group of students is on average 20 years older than the pre-service group of students.

Chi Square test for Promoters as indicated in table on page 65

The expected frequencies have been indicated in parantheses.

This table shows me which aspects (hereafter referred to as 'promoters') the two groups of students indicated as promoting their access to and use of ICTs on the WSOE campus

I have employed the Chi-Square test to validate this data. This test is applied to a single

		skills	help	access	technology	Quiet environment	interest	typing	nothing	total
Experimental	Inservice	57 (68)	39 (27)	28 (20)	1 (5)	0 (4)	1 (2)	0 (2)	10 (8)	136
Control	Preservice	206 (195)	66 (78)	50 (58)	19 (15)	16 (12)	6 (5)	6 (4)	19 (21)	388
	total	263	105	78	20	16	7	6	29	524

categorical variable from two different populations. The standard population group is the pre-service group, the experimental group is the older in-service group of students. I will investigate whether the frequency counts are distributed identically across different populations and if they are not, to what extent they differ.
I have asked both groups of students to identify aspects that they find promote their use of and access to ICTs. Both groups of students have been asked the same question and I will use the Chi-Square test to determine whether the indicators experienced by the experimental group of in-service students differ significantly from the standard population group of pre-service students.

The data has been sampled from two populations and the categorical variable has 2 levels – either yes or no.

Problem:
Do the in-service group experience different promoters when attempting to access ICTs on the WSOE campus?

Null hypothesis – there is no difference in the promoters experienced by both groups. They both experience the same promoters.
Alternative hypothesis – there is a difference in the promoters experienced by the two groups.

Null hypothesis implies that there is no relationship between the row and column frequencies
I will use a 0.05 level of significance

Degree of freedom

Df=(r-1)*(c-1)

Where r is the number of populations in this study (2) , the group of pre-service students and where c is the number of levels for the categorical variables, in this case the promoters that the students indicated hindered their access to ICTs

Df =(2-1)*(8-1)
=1*7

Df =7

To determine the P value

Er,c=(nr*nc)/n

E1.1 = (136x263)/524 = 68.26
E1.2 = (136x105)/524 = 27.25
E1.3 = (136x78)/524 = 20.24
E1.4 = (136x20)/524 = 5.19
E1.5 = (136x16)/524 = 4.15
E1.6 = (136x7)/524 = 1.81
E1.7 = (136x6)/524 = 1.56
E1.8 = (136x29)/524 = 7.53

E2.1 = (388x263)/524 = 194.74
E2.2 = (388x105)/524 = 77.75
E2.3 = (388x78)/524 = 57.76
E2.4 = (388x20)/524 = 14.81
E2.5 = (388x16)/524 = 11.85
E2.6 = (388x7)/524 = 5.18
E2.7 = (388x6)/524 = 4.44
E2.8 = (388x29)/524 = 21.47

$x^2 = \text{sum}[(Or,c - Er,c)^2/Er,c]$

$x^2 =$ $(57-68.26)^2/68.26 = 1.86$
$+ (39-27.25)^2/27.25 = 5.06$
$+ (28-20.24)^2/20.24 = 2.97$
$+ (1-5.19)^2/5.19 = 3.38$
$+ (0-4.15)^2/4.15 = 4.15$
$+ (1-1.81)^2/1.81 = 0.36$
$+ (0-1.56)^2/1.56 = 1.56$
$+ (10-7.53)^2/ 7.53 = 0.81$

$+ (206-194.74)^2/194.74 = 0.65$
$+ (66-77.75)^2/77.75 = 1.77$
$+ (50-57.76)^2/57.76 = 1.04$
$+ (19-14.81)^2/14.81 = 1.18$
$+ (16-11.85)^2/11.85 = 1.45$
$+ (6–5.18)^2/5.18 = 0.12$
$+ (6-4.44)^2/4.44 = 0.55$

$+ (19-21.47)^2/21.47 = 0.28$

$x^2 = 27.19$

The P value is the probability that a chi-square statistic having 7 degrees of freedom is more extreme than 27.19

Looking at the Chi-Square probability table
Df = 7
Predetermined level of significance 0.05
Level of significance is 14.067
x^2 is greater than this level of significance
27.19>14.067 therefore reject the null hypothesis. There is a significant difference between the data sets that cannot be due to chance alone.
Thus we conclude that there is a relationship between the promoters students experience and whether they are in-service students or not. Ultimately it can be said that age impacts on the promoters that the students experience as the in-service group of students is on average 20 years older than the pre-service group of students.

Chi Square test for Importance of ICTs in teaching and learning as indicated in table on page 72

		Very important	Important	Not very important	Not used at all	Total
Experimental	Inservice	90 (9.90)	15 (82.50)	1 (15.02)	30 (6.69)	136
Control	Preservice	248 (3.51)	109 (28.92)	27 (5.27)	4 (2.35)	388
	total	338	124	28	34	524

The expected frequencies have been indicated in parantheses.

I have employed the Chi-Square test to validate this data. This test is applied to a single categorical variable from two different populations. The standard population group is the pre-service group of students, the experimental group is the older in-service group of students. I will investigate whether the frequency counts are distributed identically across different populations and if they are not, to what extent they differ.
I have asked both groups of students to indicate on the importance of ICTs in teaching and learning. Both groups of students have been asked the same question and I will use the Chi-Square test to determine whether the perceptions of the experimental group of in-service students differ significantly from the standard population group of pre-service students.

The data has been sampled from two populations and the categorical variable has 2 levels – either yes or no.

Problem:
What value do the two groups of students place on the importance of ICTs in teaching and learning?

Null hypothesis – there is no difference in the perceptions voiced by both groups. Alternative hypothesis – there is a difference in the perceived importance of ICTs in teaching and learning between the two groups.

Null hypothesis implies that there is no relationship between the row and column frequencies
I will use a 0.05 level of significance

Degree of freedom
Df=(r-1)*(c-1)
Where r is the number of populations in this study (2) , the group of pre-service students and where c is the number of levels for the categorical variables, in this case the barriers that the students indicated hindered their access to ICTs
Df =(2-1)*(4-1)
=1*3
Df =3

To determine the P value

Er,c=(nr*nc)/n
E1.1 = (136x338)/524 = 87.73
E1.2 = (136x124)/524 = 32.18
E1.3 = (136x28)/524 = 7.26
E1.4 = (136x34)/524 = 8.82

E2.1 = (388x338)/524 = 250.27
E2.2 = (388x124)/524 = 91.81
E2.3 = (388x28)/524 = 20.73
E2.4 = (388x34)/524 = 25.17

x^2 = sum[(Or,c – Er,c)^2/Er,c]

x^2 = (90-87.73)^2/87.73 = 0.06
+ (15-32.18)^2/32.18 = 9.17
+ (1-7.26)^2/7.26 = 5.39
+ (30-8.82)^2/8.82 = 50.86
+ (248-250.27)^2/250.27 = 0.02
+ (109-91.81)^2/91.81 = 3.22
+ (27-20.73)^2/20.73 = 1.89
+ (4-25.17)^2/ 25.17 = 17.80

x^2 = 88.41

The P value is the probability that a chi-square statistic having 3 degrees of freedom is more extreme than 165.27

Looking at the Chi-Square probability table
Df = 3
Predetermined level of significance 0.05
Level of significance is 7.81
x^2 is greater than this level of significance
88.41>7.81 therefore reject the null hypothesis. There is a significant difference between the data sets that cannot be due to chance alone.
Thus we conclude that there is a relationship between the perceptions students have on the value / importance of ICTs in teaching and learning and whether they are in-service students or not.