From digital divide to digital equity: Learners' ICT competence in four primary schools in Cape Town, South Africa

G.B. Gudmundsdottir
Institute for Educational Research, University of Oslo, Norway

ABSTRACT

This study explores factors influencing the digital divide in four schools in Cape Town, South Africa. Three of the schools are for disadvantaged learners whereas the fourth was previously for whites only. All the schools use ICT in their curriculum delivery and thereby support the emphasis of provincial educational authorities on ICT access for all learners and teachers. Seventh-grade learners (N = 290) as well as their class teachers and principals participated in the study which focused on factors inside and outside of school which affected learners' ICT competence, and hence the digital divide. Data were collected through interviews, observations and questionnaires. Learners' ICT competence was compared between and across schools in relation to gender, home access and home language in addition to support and training possibilities for the teachers. The main findings indicate that, despite substantial efforts by educational authorities to increase ICT access for learners and teachers in public schools in Cape Town, when learners' ICT competence is compared, digital equity has not been reached. In order to increase digital equity and decrease the digital divide, a renewed policy focus is needed which puts greater emphasis on addressing the severe inequalities of the learners within their school environment as well as outside of school, taking their home situation into consideration to a greater extent.

Keywords: Capability approach; ICT competence; school use; home access; home language; digital divide; digital equity

INTRODUCTION

South Africa as a nation is characterised by inequality trends deeply rooted in its history of apartheid. These inequalities include income and wealth inequalities as well as disparity in accessing education, health care, housing and other social infrastructure (Bloch 2009; Chisholm 2004; Fiske & Ladd 2004; Soudien 2004). One aspect of the disparity within education includes access and use of information and communication technology (ICT) which is often connected to the concept of a digital divide. The term "digital divide" is defined in various ways, and its use and meaning are strongly debated. In general, the term has been used to describe the mismatch in access to and use of ICT (Compaine 2001; Norris 2001; van Dijk 2005; Warschauer 2004). The focus of this study is the digital divide when exploring learners' access to and utilization of ICT.

Emphasis on computer access has accelerated in South African schools in recent years. At the same time, greater demands are placed on learners and their teachers to use ICT in learning and the curriculum delivery of different subjects (Department of Education 2004a, 2004b; Miller, Naidoo & Van Belle 2006). Likewise, educational authorities in the Western Cape Province have aimed at increasing access to ICT for all learners and teachers to empower previously disadvantaged[1] learners and teachers and to correct the existing ICT disparity (Western Cape Education Department 2003). The Western Cape Education Department (WCED) established the Khanya initiative in 2001. Its goal was to expose all learners and teachers in public schools to ICT and increase their ICT competence. However, studies have shown that access to computers at home is increasingly playing a role in scholarly debates on the digital divide (Stevenson 2008). In South Africa, home access to computers is largely influenced by class divisions, and not common

for the majority of people. The less advantaged part of the population does not own personal computers, whilst the more affluent households have steady computer access (Langa, Conradie & Roberts 2006; Sayed 1998).

When the ICT competence of learners is explored, many factors need to be considered, including their socio-economic background, gender, education and training, location and language. All of these can be a part of explaining the existing digital divide and the use of ICT. This article reports findings from a study conducted in four schools in Cape Town on seventh-grade learners and their access to, use of and competence in ICT. Despite ICT access at school, individual differences and home access can affect learners' use and skills. In this article, the aim is to identify some of the factors within school (internal) and outside of school (external) that can help explain differences in learners' computer use and ICT skills and thus increase understanding of the digital divide in South African classrooms.

DIGITAL DIVIDE AND CAPABILITIES

As discussed earlier, the term "digital divide" is often used to describe inequalities in access to and use of ICT. Thomas and Parayil (2008) claim, however, that ICT policy documents often lead to a focus on the mere lack of material access to computers. This implies that providing access by either increasing the number of computers and/or giving learners equal time in the computer room does not automatically lead to increased use (Chigona, Mbhele & Kabanda 2008). Chigona et al. (2008) underline the importance of research going beyond simple access definitions by including issues such as literacy, language and education as well as focusing on excluded groups. Chen and Wellman (2004, p.39) argue that:

> *people, social groups and nations on the wrong side of the digital divide may be increasingly excluded from knowledge based societies and economies.*

A digital divide can therefore be referred to as the lack of access to necessary material, human and social resources in order to be able to use computers in a meaningful way (van Dijk & Hacker 2003; van Dijk 2006; Warschauer 2004; Warschauer & Matuchniak 2010).

In this study, an accessibility and learners' ICT competence perspective is adopted, bearing in mind Sutton's (1991) definition of equality and equity in the context of computer access and use. Sutton asserts equality refers to parity in access to and use of computers or the internet in quantitative terms whereas equity is a qualitative property referring to justice or fairness in use and opportunities. Equity involves changing aspects and actions taken that particularly benefit disadvantaged groups in order to increase their access and use. Likewise, the term "ICT competence" will be used together with the term "ICT skills", which contains a slightly narrower meaning. ICT competence is understood to involve basic skills in ICT and

> *the use of computers to retrieve, assess, store, produce, present and exchange information, and to communicate and participate in collaborative networks via the Internet (European Union 2006, p.L394/315).*

To address the digital divide, many nations have increased ICT access for learners in schools. UNESCO states that empowering people through "information and media literacy" is an essential precondition for equitable access and inclusive knowledge societies (UNESCO 2010). Global initiatives such as the 'One Laptop per Child' and the 'Hole in the Wall' global project exemplify initiatives to increase ICT access for disadvantaged children in Africa and South Asia (DISE 2010; Hole in the Wall 2010; One Laptop per Child 2010). DiMaggio, Hargittai, Celeste and Shafer, however, point out the importance of factors such as gender, ethnicity, location, age,

education, income, employment and family structure in connection with computer use and skills (DiMaggio et al. 2004). Thomas and Parayil (2008) also note that socially disadvantaged classes' ICT competence is hindered not only by access but also by other factors such as low education and lack of specific skills which may actually widen existing inequalities. When exploring the digital divide, ICT competence and utilisation in relation to social hierarchies are therefore important players and add a dimension to the discussion. Indeed, Chen and Wellman (2004) claim that the proliferation of internet use in developing countries has statistically narrowed the digital divide in terms of material access but is still substantial or even greater due to lack of skills.

During the 1990s, research in western settings showed distinct gender differences in computer use and skills (see Jakobsdottir 1996, 1999). Current studies which have focused on the effects of gender on variance in ICT use show that gender differences still exist even though they are not as clear as before (Banerjee et al. 2005; Cotten, Anderson & Tufekci 2009; Jackson et al. 2008; Nsibirano 2009; Sanders 2006; Volman et al. 2005).

Moreover, Attewell and Battle (1999) have studied home access in connection with school performance. They found that, when comparing children's home access, children from low socio-economic status (SES) homes gained considerably less than children from high SES homes. Selwyn's (1998) study on the effects of using a home computer on learners' educational use of ICT revealed that those having access at home gained considerable advantage as evidenced in his report even though this was not always connected to actual skill level but more to positive attitudes towards computer use (Selwyn 1998). Nevertheless, Cuban (2001) asserts that material access to ICT in schools does not guarantee effective use or ICT competency.

According to the capability approach (CA),

> *two persons with the same actual capabilities and even the same goals may end up with different outcomes because of differences in strategies or tactics that they respectively follow in using their freedoms (Sen 1992, p.82).*

In that way, computer skills or capabilities can be argued to be central for learners' educational gain, but the way the learners utilise their capabilities is influenced by conditions at home and in school. The CA distinguishes people's capabilities and functioning, which is defined as

> *an achievement, whereas a capability is the ability to achieve. Functionings are, in a sense, more directly related to living conditions, since they are different aspects of living conditions. Capabilities, in contrast, are notions of freedom, in the positive sense: what real opportunities you have regarding the life you may lead (Sen, Hawthorn & Muellbauer 1988, p.36).*

This study is founded on the CA to development and focuses on the difference between those being able to use ICT, the "cans" and "can nots", instead of the "haves" and "have-nots". The CA is used in view of its intensive use in scholarly work on ICT and development to explain the inequalities within ICT use and existing divides (Liu, Cornish & Clegg 2007; Thomas & Parayil 2008; Wresch 2009).

CA also allows a wide focus unlike the traditional method of perceiving the information society and development merely through a focus on growth in infrastructure, number of internet hosts, tele-density and so on (Alampay 2006). When Sen (1997) emphasises human capability as the ability for people to lead the lives they have reason to believe can enhance their choices, he argues that education can increase an individual's human capital. Every person's capabilities influence however the freedom one has to lead one's life and make choices (Sen 1997). Furthermore, individual differences influence peoples' skills, capabilities and freedoms when

using ICT (Alampay 2006; Robeyns 2005; van Dijk & van Deursen 2009). Zheng (2009) similarly agrees when applying the CA approach to ICT in a development context that users are not viewed as passive receivers in economic progress based on technological utilities but are rather connected to the needs and expectations in the users' social, cultural and historical environment.

Thus, from a CA perspective, the following research questions have guided the study: Which factors inside and outside of school significantly affect the digital divide? How do these factors affect the ICT skill level of learners and their capabilities?

METHOD

Design

The paper is based on fieldwork conducted in four schools in Cape Town, South Africa. The data collection was conducted during the first two semesters in 2007, from January to July. A mixed-method approach was used to gather data in order to provide a broad understanding and comprehensive analysis of the research problem. The concurrent mixed method approach was used (Creswell 2009) as qualitative and quantitative data were collected concurrently and used for analysing and interpreting the findings and cross validation. The qualitative methods were classroom observations and interviews which provided in-depth information. The quantitative data were collected with a questionnaire and widened the scope of the data material.

Participants and school context

The primary focus was on three schools for disadvantaged learners, which signify that the learners are black and coloured. These schools were given the pseudonyms Acadia, Eaglewood and Xolani. A school, Freewill, formerly for white learners only, was added to broaden the digital divide spectrum and to discover the challenges different learner groups in Cape Town face. All the schools in this study have addressed equality in ICT access by increasing material access to computers. However, the participating schools should not be considered exhaustive or representative of all schools in Cape Town or South Africa. Neither should they be considered to reveal extreme examples of each side of the ICT skills continuum in Cape Town. A pilot study in one township school and one previously white school was more revealing of such extremes (Gudmundsdottir & Brock-Utne 2010).

Thirty-four randomly selected learners participated in the interviews: 14 learners from Acadia (eight from the Afrikaans class and six from the two English classes), 10 learners from Eaglewood and 10 from Xolani. The principals plus two teachers from each of the disadvantaged schools were interviewed as well. In total, 290 seventh graders answered a questionnaire, the majority of seventh graders in the participating schools: 75% of the seventh graders in Freewill, 89% of the learners in Xolani and Eaglewood and 91% of the seventh graders in Acadia.

The schools were selected from a list of Khanya schools, the ICT initiative within the WCED; all were contacted by e-mail before the data collection and fieldwork were performed. The criteria for choosing schools were that the learners should have some prior experience using ICT, they should reflect the linguistic diversity of the learner group in Cape Town and they should preferably use different languages as language of learning and teaching (LoLT). These sample criteria were chosen after the pilot study which revealed the importance and severe challenges of linguistic diversity in education in South Africa (cf. Gudmundsdottir & Brock-Utne 2010). Moreover, a move away from sensitive race or ethnic distinctions which were previously used in South Africa when categorising learners was considered important. The interviewed learners were randomly chosen from the seventh-grade classes after all the learners had returned a parental consent form.

The schools are located in different areas of Cape Town, which can indicate the socio-economic background of the learners (see Table 1). The location of the schools also partly defines the quintile[2] of the school, which again defines the school fees learners need to pay. Since state subsidies are higher in schools for disadvantaged learners (Xolani, Acadia and Eaglewood) than in the former white school (Freewill), the parents pay higher school fees to compensate for lower state subsidies. This excludes many of the disadvantaged learners from attending former white schools in the affluent areas of the city. School fees influence equipment and resources within the school (for example, the number of teacher positions per learner, class size, book stock and number of computers). The location of the school also defines the dominant language within and surrounding the school and partly the SES as well as the home language (HL) of the learners. The schools moreover differ in size. Acadia and Xolani are large. Whereas the 98 learners in grade 7 in Xolani are placed in two classes, the 103 learners in seventh grade in Acadia are divided into three classes. Eaglewood is a small school with only one class for each grade level. In grade 7, there were 35 learners. In Freewill, there were four grade 7 classes with approximately 26 learners in each. In all of the schools, there was one computer room. The number and size of the classes indicate some of the differences in resources and material access to computers. Whereas in Xolani two to three learners had to share one computer, the learners in Freewill each had a computer to work on.

Table 1: The context of the school

School name and no. of learners (no. of 7th-grade classes)	Location of school	Total no. of 7th grade learners (No. of 7th graders answering the questionnaire) N = 290[3]	Home language speakers in gr. 7[4] N = 282	Language of learning and teaching	Annual school fees in South African Rand (in 2007)
Xolani 892 (2)	Township school in central Cape Town	98 (87)	isiXhosa (85)	isiXhosa gr. 1-3, English from grade 4	0
Acadia 926 (3)	Eastern suburbs of Cape Town, Afrikaans-speaking neighbourhood	103 (94)	Afrikaans (46) English (35) isiXhosa (8)	Parallel medium Afrikaans and English	460
Eaglewood 260 (1)	Southern suburbs of Cape Town. English-speaking neighbourhood, but majority of learners live in surrounding townships	35 (31)	isiXhosa (16) Afrikaans (2) English (10)	English	650
Freewill 699 (4)	Southern part of Cape Town, English-speaking affluent area	104 (78)	English (67)[5] Afrikaans (7) isiXhosa (6)	English	7000

One of the clear differences between the schools is the language the learners speak at home. In Xolani, the great majority of the learners speak isiXhosa. They are taught in isiXhosa the first three years of school, but in grade 4 the teachers are expected to shift to English even though many of the lessons are conducted in isiXhosa or at least by code switching between isiXhosa and English. Acadia has learners from all the three main language groups, but the majority are Afrikaans HL speakers, and the school has been predominantly Afrikaans speaking. However, two of the three seventh-grade classes are now English medium classes whereas one uses Afrikaans as LoLT. Eaglewood is a mixed school with learners from all the language groups. Most of the learners come from townships or settlements in the neighbourhood and speak isiXhosa or

English at home. There are also several Afrikaans-speaking learners in Eaglewood. The LoLT in Eaglewood is English from grade 1. In Freewill, however, the learners mostly speak English at home, and the LoLT is English. Freewill's location in an affluent area of Cape Town indicates the more advantageous background of the learners compared to the learners in the three disadvantaged schools.

Instrument

Four semi-structured interview guides were used during the interview sessions with (a) learners, (b) teachers, (c) principals and (c) others. The group of others included WCED officials and educational specialists. The learners' interview guide was structured thematically around inside school access and outside school access with subsequent questions. Additionally, themes such as LoLT, learners' HL and learners' attitudes towards ICT in general were brought up. The interview guides for teachers, principals and others also included questions on ICT implementation, policy framework and other contextual factors.

Part of the questionnaire was adapted from a series of studies on school computer culture conducted in Iceland from 1998 to 2008 (Jakobsdottir 2008). These provided the fundaments in constructing a questionnaire fitted to the context in Cape Town. The questionnaire was piloted in two schools in Cape Town. After the pilot study, the questionnaire was further modified in order to fit the local context and the research focus. This included reducing the use of questions with answers on a Likert scale and further simplifying the language and structure. It was also considered necessary that the questionnaires would be available in the three main languages of the learners, English, Afrikaans and isiXhosa, so that the learners themselves could choose the language they found easiest to respond in and to do justice to the different languages. The translations were done with the help of local experts and researchers from the University of the Western Cape in Cape Town.

One particular question on the questionnaire will be reported here together with a question on HL and home access of learners. The question reads as follows: 'Here is a list of things people sometimes do on a computer. Please tick off those that you already know how to do'. A list of 14 skills followed. The skills are categorised as shown in Table 2.

Table 2: *Overview of skills*

Categories	Skills
Information finding and retrieval:	Seek information on the internet Seek information on a CD-ROM Copy from the internet Copy/download music from the internet
Online communication:	Chat Blog
Creativity/presentation:	Design web pages Draw/design Make presentations Write text
Analytical skills/programming:	Programming software Use data calculations
Play/games:	Play computer games Play internet games

As the seventh-grade learners had used computers for several years at school, questions concerning basic skills and file management (such as opening, saving, deleting and printing documents or installing software) were intentionally not included in the questionnaire. The classroom observations, however, revealed that some of the learners had limited command of the most basic applications. If these basic skills had been included in the list of skills, the mean number of skills learners reported would have been higher.

Procedure

The fieldwork started with classroom observations in order to become acquainted with the learners and teachers as well as the "computer culture" in the schools (Gudmundsdottir & Jakobsdottir 2009). Each of the three disadvantaged schools (Acadia, Eaglewood and Xolani) was visited one to two times a week during the seventh-graders' computer sessions[6] in the computer lab. Freewill participated only in the quantitative part of the study; thus, the learners and teachers were not formally interviewed or observed. During the observations, field notes were taken focusing primarily on learners' skills and use of the computers but also on the language issue in the classroom as well as teacher learner interaction and interaction between the learners themselves.

After observations had been conducted in Acadia, Eaglewood and Xolani's computer rooms for nine weeks, the learners were asked to fill in a close-ended questionnaire. In total, 290 seventh graders answered the questionnaire on their use of computers within and outside of school. There were also questions regarding learners' language background and attitudes connected to computer use. It was important that the questionnaire reach the majority of learners in order to get a broad overview of the skills and access inside and outside of school. In Freewill, the learners answered the questionnaire at the end of the fieldwork period as they participated only in the latter part of the fieldwork. The majority of learners were included in the quantitative part of the study to better grasp the great complexity of the learners' background, which was difficult to cover in the smaller sample of interviewed learners.

The interviews with the principals in the disadvantaged schools started shortly after the fieldwork started, and each one was interviewed several times formally (including audio-recorded interview sessions) and informally. The class teachers for grade 7 and the teachers assigned responsibility for the computer room were interviewed in order to verify the findings from the observations and to cross check if their views on ICT use in the classroom coincided with the learners' views. The seventh-grade teachers were interviewed at their convenience during the latter part of the fieldwork mostly after school hours. The learners were also interviewed in the latter part of the fieldwork partly to address some of the preliminary findings from the questionnaire. Whereas the formal interviews were all audio-taped and transcribed, informal conversations with teachers, other staff at the schools and educational specialists also took place and were used to triangulate the findings from the formal interview sessions. The learners were interviewed in pairs in order to make the interview situation less intimidating for them. The arrangement worked well and enabled communication, but made the transcribing process more complicated.

The interviews were conducted in English and in isiXhosa. The Afrikaans-speaking learners in Acadia and the isiXhosa learners in Acadia, Eaglewood and Freewill were interviewed in English. The questionnaires were, however, available in all three languages. As a result of the experiences during the initial observations and possible language barriers, an isiXhosa-speaking interpreter was present during all the learners' interviews in Xolani. The interpreter helped translate the questions and learners' answers when necessary. In order to verify the translations, a professional isiXhosa-speaking translator transcribed the interviews from the audiotapes. The

interviews lasted from 20 minutes up to two hours. The learners' interviews were typically shorter than the interviews with the teachers.

Ethical considerations

Research clearance was granted by the Western Cape Education Department (WCED) and the management of the Khanya project[7] in the summer of 2006. The principals permitted the research in their schools, and a parental consent form was sent out from the principal's office in the three focal schools where formal interviews and observations were conducted. The learners could withdraw at any time from participating in the research. After the learners had been randomly selected to participate in the interviews, the learners were told that their participation was on a voluntary basis. All of the learners indicated that they were willing to continue their participation, and all the learners present on the days when the survey was conducted participated.

Data analysis

The qualitative data (observations, interviews and field notes) were analyzed within NVivo 8. Initially the data were explored to identify and index thematic content and emerging categories, including issues regarding teachers, school leadership, students use, language issues and support. These were further divided into more precisely defined sub-themes. A cross-case analysis was conducted to identify differences and similarities between schools, language groups, HL and gender. The quantitative data were analyzed in SPSS v.16.0 using descriptive statistics, including frequencies, means, percentages and standard deviation. Learners' skill level was estimated from the mean number of ICT skills each student had reported. Learners who had reported 0 to 3 skills were grouped and set at level 1, those who had indicated 4 to 8 skills at level 2 and at level 3 if they had indicated 9 or more skills. Chi-square and analysis of variance (ANOVA) values were examined to test for significant differences between means of skills and variance between groups. A post-hoc Games-Howell test, which is recommended when the group sizes vary, was used to do multiple comparisons.

RESULTS

In this section, an overview will be given presenting the learners' self-reported skills as well as skill level. The data presentation is primarily based on the quantitative data. Then a discussion follows on specific internal and external factors that affected learners' opportunities and capabilities to raise their ICT competence and skills. This discussion draws examples from the qualitative and quantitative data.

Self-reported skills

Thirty-one percent (31%) of the learners were categorised as being on level 1, 40% of the learners were on level 2 and 29% of the learners were on level 3. The mean number of skills for all the learners (N = 290) is 6.10 (SD = 3.68). A (4x2) ANOVA revealed significant differences by school (F(3,280) = 63.34, p < 0.001) in the mean number of ICT skills, but there were no clear gender differences. Furthermore, the difference in home access by gender was not significant, which indicates that girls and boys in the study have equal access to computers outside of school. The mean number of skills reported by the girls is 5.76 (SD = 3.57), and the mean number of skills reported by boys is slightly higher, but not significantly higher, at 6.47 (SD = 3.79). The only gender difference mentioned in the interview data was by teachers in Acadia, who

talked about the girls in general as more motivated in school. The learners themselves did not address the issue of gender in connection with ICT skills and use.

When the quantitative data were examined, the range of ICT skills reported in the four schools of the study was wide. The learners in the previously white school, Freewill, reported the highest mean number of skills, M = 9.15 (SD = 3.12). These learners were followed by the Eaglewood learners, who reported a mean number of skills of 7.8 (SD = 2.40). The learners in Acadia reported a mean number of skills of 5.78 (SD = 3.41), and the Xolani learners reported a mean number of skills of 3.10 (SD = 1.91). Even though the ANOVA calculations revealed a general significant difference by school, a post-hoc Games-Howell test was conducted to determine whether the difference between the schools was significant. The mean difference between Acadia and Eaglewood was 2.03 (p = .003), between Acadia and Xolani the mean difference was 2.68 (p = .000) and between Acadia and Freewill, the mean difference was 3.38 (p = .000). When the difference between Xolani and Eaglewood was explored, the post-hoc test revealed a mean difference of 4.71 (p = .000) and between Xolani and Freewill the mean difference was 6.06 (p = .000). Finally, the mean difference between Eaglewood and Freewill was 1.35 (p = .083). The post-hoc test results reveal a significant difference between the schools, except between Eaglewood and Freewill, the two schools with the highest mean number of skills.

In the interviews, the learners from Eaglewood reflected to a greater extent on their computer use and the role of ICT in learning and everyday life and work. Their understanding and attitudes towards ICT were, in other words, more complex even though the majority of the learners in Acadia and in Xolani were also greatly enthusiastic about ICT and computers in general. A difference between the schools in the qualitative data occurred, for example, when learners were asked to reflect on the difference between lessons in the computer room versus lessons in the classroom as well as when asked a question on the role of ICT and why learning to use computers was important.

Looking further at individual skills, Table 3 gives an overview of the percentage of learners who answered they already knew each of the skills. The first column reports all seventh graders in all the schools whereas the next columns show the percentage of seventh graders within each school that reported each skill. Most of the learners, or 74%, indicated that they knew how to play computer games. In addition, the great majority, or 71%, of the learners indicated that they knew how to write a text, 58% knew how to play internet games and 54% how to use different drawing or design programmes. The smallest proportion of learners reported that online communication such as blogging (21%) and software programming (20%) were skills they already had. As the skills listed in question 11 are not exhaustive, the learners were also given the opportunity to add skills that they could define themselves to the list. A few of the learners used that opportunity (*n* = 19, or 6.6%). However, they mostly revealed basic skills (such as downloading, copying or making folders), which had already been excluded from the list. A few other skills were mentioned that were easily categorised within the existing categories (such as copying films and using chat programmes).

Looking at each of the schools reveals a slight variance between the skills reported in each school. Interestingly, the majority of Xolani learners reported they know how to perform data calculations on the computer. This may be connected to the frequent use of the CAMI maths software, one of few programmes available for the learners and teachers in Xolani.

Table 3: Percentage of learners knowing certain skills

Percentage of all 7th gr. learners answering they already know how to:		Within 7th gr. Acadia in %	Within 7th gr. Eaglewood in %	Within 7th gr. Freewill in %	Within 7th gr. Xolani in %
Play computer games	74	86	97	96	33
Write text	71	53	97	82	70
Play internet games	58	72	84	82	12
Draw/design	54	53	84	74	26
Seek information on the internet	51	50	74	90	9
Copy material (text, pictures) from the internet	50	45	74	85	15
Copy/download music from internet	45	49	36	76	17
Use data calculations	45	19	77	28	76
Chat on the internet	37	43	13	64	14
Seek information on a CD	34	36	26	56	15
Design web pages	28	18	42	63	3
Make presentations/overheads	22	20	61	44	1
Blog on the internet	21	22	3	40	9
Programming software	20	20	13	36	9

School factors

Possible indications of the disparity in computer use and in the skill level of learners in the disadvantaged schools were revealed when location, class size and LoLT were compared between the schools (see Table 1). Additionally, the qualitative data revealed, for example, a clear difference in the teaching methods and views of the teachers when using the computer room. In Eaglewood and Freewill, the methods used were learner centred whereas in Acadia and Xolani they tended to be more teacher centred. In Freewill, the majority of lessons in the computer room were conducted by a specially assigned computer teacher who had formal computer training from pre- and in-service courses. The computer teacher in Eaglewood had also taken a one-year full-time diploma course in computer-assisted education at the University of Pretoria. According to the principals in Xolani, Acadia and Eaglewood, the majority of the teachers had no formal training in the use of ICT, apart from the initial training module provided by the Khanya initiative. This training module varied from school to school in length and duration (cf. Gudmundsdottir 2010). According to several of the teachers, this training had not focused on the pedagogical use of computers with learners but rather focused on basic computer literacy in order to reach the majority of the teachers[8]. As one of the teachers in Acadia said:

> some of them [the teachers] had no contact with computers at all. It was a brand-new thing. So when Khanya came here, some of the more mature teachers at the school felt a bit intimidated by the technology… so we took it [the training component] on a base or level were everybody is brand new to this thing, so we started from that side (Pieter, interview 180507).

Indeed, some of the teachers did not feel at ease with the technology. In Xolani, there were problems getting the teachers to use the computer room with their classes, and as Menzi and

several other teachers mentioned, the teachers lacked support and help in knowing which software to use in a particular learning context.

> *We've found out that when the class is supposed to be here at a certain time, it is a challenge because they don't come. The teachers are not interested. They are not computer literate, the teachers. If maybe they can be provided with some computer courses. Maybe the teachers should know that this is the programme that will assist you with this and that. (Menzi, interview 230507).*

The teachers in the disadvantaged schools were new to the technology and may therefore need extra support to start using computers with their learners. In Acadia, repetitive use of two particular computer programmes was apparent. These programmes were the ones the teachers got special training in using with their classes, and the teachers rarely used other programmes during computer sessions with their classes. Jacobus, a teacher in Acadia, said that they did not know how to use all the programmes, whereas his colleague Pieter in the same school explained that the reason for not using more programmes was lack of time.

Both Eaglewood and Freewill prioritised having a designated computer teacher who served as a computer teacher for the learners and as a supportive colleague for the other teachers when they needed assistance. Even though the teachers in Eaglewood claimed they got a lot of support, William still admitted that his personal wish would be to:

> *get more time…or if it is a form of a manual or whatever guide, a training manual or something where I could read and be in the computer room and continue with it and explore all the various possibilities (William 220507).*

On a similar note, Sophia, also a teacher in Eaglewood, says that she thinks:

> *Every school should have a teacher dedicated to teaching [computers] like we have. Because to me it should be treated the same as art or dance but of course integrated… but everybody does not have, what I noticed from the teachers, the confidence, the time, the patience (Sophia 220507).*

The teachers in Acadia and Xolani did not have support from a computer teacher in the computer room. This was partly due to lack of resources as a special computer teacher had to be taken off the limited teaching resources each school had. The teachers in Acadia and Xolani could therefore ask colleagues for help during breaks or after school hours. This may explain that on occasion teachers did not show up with classes in the computer room even though it was their "turn" on the timetable. This was particularly noticeable in Xolani where the computer room was not in use on several occasions during the observation period.

In a school where many of the learners do not have access to computers outside of school and many of the teachers have not used the technology before, access to support matters a great deal. In Eaglewood, the principal was eager to give the learners the opportunity to learn how to use ICT, and he emphasised the use of ICT at all levels in school. He encouraged the teachers and administrative staff as well as the learners to practise their computer skills. The principal and the computer teacher had established a popular computer club for the learners (extracurricular activity), and the teacher had also given computer courses for the staff and the parental community. In Freewill, the parental community supported and provided some of the equipment in the computer room and were actively involved in the computerisation in school. Even though the principals in both Xolani and Acadia recognised the importance of ICT use and supported its use in school, they were not as actively involved in supporting ICT use as the principal in Eaglewood.

Even though one of the points made earlier in this paper is not to focus on pure material access alone, it is clear that the frequency of use and time spent in the computer room plays a role not only for the skills of the learners but also for the teachers. The access to support and adequate training possibilities is likewise of great importance. Some of the internal factors have now been considered and their possible influences on the digital divide. Following is an exploration of external factors which influence the use of ICT within the school environment.

External factors

Exploring external factors puts a focus on the role of home access to computers and the internet in learners' self-reported skills. Of the 287 learners answering question 5 on home access to computers and Internet, 148 learners, or 52%, answered that they had access to a computer at home, whereas 139, or 48%, indicated no access. In following up these numbers in the interviews with the learners, several of the interviewed learners (and teachers) claimed that the computers they had access to at home were either broken or not working properly. The strong desirability to own a personal computer may have resulted in a somewhat skewed answer to this question.

Furthermore, a chi-square test revealed that there were significant differences by school in computer and internet access, χ^2 (3, N = 287) = 90.59, p < .001 and χ^2 (3, N = 277) = 86.69, p < .001, respectively. The learners in the disadvantaged schools were less likely to have computer and internet access at home than the learners in Freewill (see further Gudmundsdottir & Jakobsdottir 2009). Similarly, a chi-square test also revealed that there were significant differences by home access and skill level, χ^2 (2, N = 287) = 41.20, p < 0.001). The skill level tended to be higher for learners with access to computers at home.

Figure *1* shows how ICT skill level differed by learners' access to computer at home. Almost half of the learners (46%) who do not have access to a computer at home (black columns) are represented in the lowest skill group, i.e. at level 1, while 43% of the ones who have access to a computer at home (grey columns) are categorised in the level 3 group. Around 40% of the learners with and without access to computers at home are however categorised in the level 2 group.
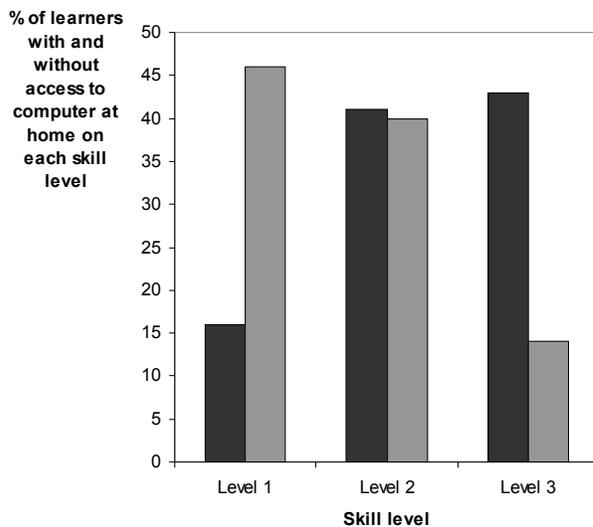
Figure 1: *Computer at home by skill group (with access = black, without access = grey)*

For the learners who had replied that they had access to computer at home, the reported mean number of skills was 7.50 (SD = 3.68) whereas the learners who did not have access at home reported a mean number of skills of 4.62 (SD = 2.99). The majority of the learners in Freewill (83.3%) reported home access to computers, and 70.1% have access to an internet-connected computer. In contrast, only 13% of the learners in Xolani have access to a computer at home, and less than half of these, or 4.8%, have access to an internet-connected computer (see Table 4).

Table 4: Access to computers and the internet by school and by home language

School	Percentage of learners having **computer** access at home (*N* = 287)		Percentage of learners having **internet** access at home (*N* = 277)	
	n	%	n	%
Acadia	60	64.5	22	25.6
Eaglewood	12	38.7	5	16.7
Freewill	65	83.3	54	70.1
Xolani	11	12.9	4	4.8

These findings were also supported in the qualitative interviews conducted with learners and teachers. The majority mentioned different skill levels of learners in their class. When asked about a possible explanation for this, the answer was often that those with computers at home were better than the others. Vanessa (030507), a learner in Acadia, answered when asked about her classmates, that some were very good when it came to using computers and continued:

> *I think not just because they have computers at home, they know about it, they do things on their computer; the programmes that they have at home are not the same at school. If they can go on the internet, they also know more sites than the others.*

All of the participants in this study specified one language as their HL. Most of the learners spoke isiXhosa (40%) and English (39%) whereas 17% of the participants reported that Afrikaans was their HL. The majority of the learners in Acadia still had Afrikaans-speaking parents who spoke Afrikaans to each other but spoke English to their children. Many of these children reported English as their HL despite coming from traditionally Afrikaans-speaking families and culture. This may have resulted in fewer learners stating Afrikaans as their HL. A few learners (*n* = 15) reported an HL other than these three and were not included in the analysis connected to HL. Xolani was the only school with only isiXhosa-speaking learners[9] whereas in the other three schools all the three language groups were represented in the learner population.

The isiXhosa-speaking learners had less access to computers at home (16.8%) than the two other main language groups in which more than 70% had access at home (see Figure 2). The English-speaking learners had the best access to computers and the internet at home, but the Afrikaans-speaking learners also had the most access at home with more than 70% answering that they had access to a computer and more than 35% had access to the internet. The isiXhosa-speaking learners also had the least access to Internet at home or 7%.
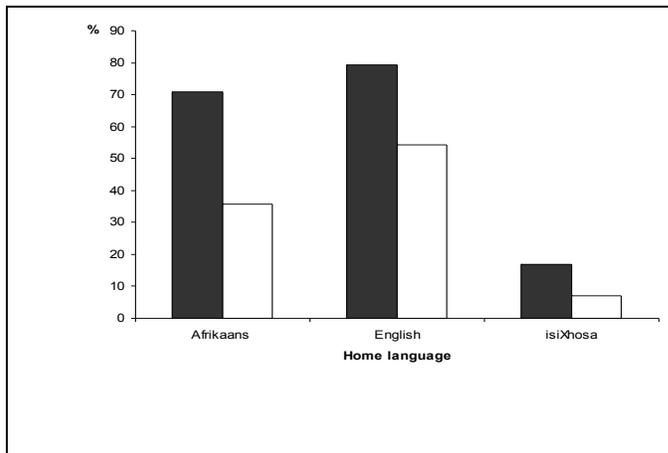
Figure 2: Home access to computers and the internet according to language groups (access to computers = black columns, access to internet = white columns)

Learners with English as their HL reported a mean number skills of 8.38 (SD = 3.12), Afrikaans HL learners reported a mean number of skills of 5.90 (SD = 3.12) and isiXhosa learners reported a mean number of skills of 4.03 (SD = 2.74). The majority of the English HL learners were either on level 2 or on level 3, whereas more than half of the isiXhosa HL learners were on level 1. The majority of the Afrikaans HL learners (58%) were categorised in the level 2 skill group. A chi-square test examining the relationship between learners' HL and their self-reported ICT skills shows a statistically significant relationship between the two variables χ^2 (4, *N* = 275) = 75.87, *p* < .001. Additionally the isiXhosa HL learners at Freewill, Eaglewood and Acadia reported more skills than the isiXhosa HL learners at Xolani. The Afrikaans HL learners are particularly well skilled at Freewill and have the highest means in the study (M = 10) when looking at each HL group within each school, but in Eaglewood, the Afrikaans learners report fewer skills (M = 6.50) than their isiXhosa-speaking classmates from the same school (M = 7.44). In Acadia, the English HL learners report slightly higher skills (M = 6.23) than the Afrikaans HL learners (M = 5.7) and isiXhosa HL learners (M = 5.4).

Summary of findings

Months of observation of computer sessions in the disadvantaged schools clearly showed that learners' ICT use and skill level varied greatly by school. Numerous earlier studies have revealed gender differences in ICT use and skills. However, the results from this study showed no gender differences. This finding may possibly be explained by the relatively limited home computer use by the participants (by both girls and boys) and/or the possible equalising effect of school use where every learner had access regardless of gender.

Factors within and outside of school influence learners' use and skills of ICT and thereby affect the digital divide between the schools. Home access and HL as well as teachers' competence and access to support play a crucial role. The difference in learner's skill level by school varies, indicating the importance of viewing the influence of the school environment more broadly than from a few selected factors such as number of computers, gender or ethnicity composition. The learners in Eaglewood who mostly live in townships are well skilled and do better than the other disadvantaged learners in the study. The difference in mean number of skills between the Eaglewood learners and the learners in Freewill is not significant. These learners do indicate a

higher skill level than the learners in Acadia and in Xolani. The Afrikaans HL learners do better in Freewill than they do in Acadia or Xolani, which supports the influence of the school rather than the influence of HL on its own. It should however be kept in mind that learners in Freewill are generally much better off than the learners attending Xolani or Acadia. The learners in Xolani who have the least access at home and the least support at school report fewer skills than the learners from the other schools. The language aspect is indeed important as especially the learners speaking isiXhosa are further disadvantaged in a classroom teaching in English with English teaching materials. In that respect, it can be argued that the holistic approach in Eaglewood, including support, after-school activities, connection with the parental community, teacher training, size and motivated and visionary leaders, compensates for learners' lack of access outside of school and serves as a stimulus and encouragement for the learners that do not have English as their HL.

DISCUSSION

One of the limitations of this study is the focus on skills as representative of the digital divide as "skill access" is only one aspect of the digital divide according to different definitions (van Dijk & Hacker 2003; Warschauer 2004). Skill level can indeed indicate learners' competence of using computers, but to address this limitation, the skill level of learners was related to other factors within and outside of school and viewed in connection with the capabilities of teachers and the learners' home background and access to computers and the internet. In that way, the approach became more inclusive and strengthened the validity of the results. The findings should, however, be seen only as an indication of a possible divide and/or lack of equity as all possible aspects influencing the digital divide have not been covered. In addition, comparing the participating schools is complicated in terms of methodology due to the different compositions with regard to size, learner population, LoLT, HL, teaching methods and so on. In addition, there is a certain selection bias when it came to deciding which schools were included in the study. Thus, the findings are not meant to generalise to all schools in Cape Town but can serve as an indicator of some of the factors influencing equity in access to and learners' skill level and use of ICT.

The differences in ICT skills reported here are affected by learners' opportunities outside of school to access and use computers. Raising the ICT competence of the learners needs to be addressed in a comprehensive way, which means that merely implementing ICT in the classrooms is not adequate for reaching greater digital equity. More attention to supporting teachers in the disadvantaged schools, especially those that do not have access and opportunities outside of school to practise and prepare their lessons, should be given. This may be done by providing regular in-service training. Moreover, the vast differences in learners' access and use outside of school are highly connected to wider social inequalities within society. Therefore, in order to achieve greater equity and access for all, the strategies and ways of implementing ICT in particular in disadvantaged schools are of immense importance.

The main aim of the Ministry of Communication in South Africa as presented in a green paper in 2000 is to increase digital literacy and provide everyone in South Africa with basic digital literacy skills (SADoC 2000). This study indicates that socio-economic differences, location and language affect learners' opportunities and freedom to use ICT within and outside of school. In fact, this also corresponds to the findings of the study on digital divide in South Africa by Langa et al. which found that it reflected "wider social inequalities in the country" (2006, p.145). Furthermore, when Czerniewicz refers to the history of South Africa, she argues that in 1994 a new South Africa was born, great optimism and hope were characteristic of the country and:

> *many people anticipated that new policies and firm measures of redress would contribute to the creation of a more equitable and fair society, and enable South Africa to become a player in the global community (Czerniewicz 2004, p.145).*

Considerable efforts have been made by educational authorities to create a holistic ICT policy. However, the policy focus needs to shift to include local realities of the learners within and outside of school in order to reach greater digital equity. The digital divide has been addressed in terms of gaining material access and by that increasing equality in access instead of addressing equity of use and providing disadvantaged learners better surroundings at school and in their community/home environment to be able to utilise ICT. School leaders, administrators and educational policy-makers have a special responsibility to equalise computer use by making ICT meaningful and empowering for all societal groups. As Sen (1992, p. 2) argues: "equality in terms of one variable [access to ICT in this case] may not coincide with equality in the scale of another" [skill level]. Therefore, it may sometimes be necessary to use unequal means or treatment to reach greater equity. Sutton claims:

> *if schools wish to provide equity for poor children with respect to their confidence and competence concerning computer learning, poor children need to be provided more in-school access—that is, inequality of access (Sutton 1991, p.477).*

Using unequal means of access within schools may be one alternative since learners' capability of using ICT outside of school is limited. Sen's "functionings", which more reflect the living conditions and external environment of the learners and can thus be connected to equality in access, are important when raising learners' capability of using ICT. Learners' capability is, however, connected to the notion of freedom and justice and real opportunities they have, i.e. with regard to equity. It is therefore important to address the concept of digital divide more holistically, with equality perspectives and a focus on learners' equity within and outside of school.

Finally, the findings of this study indicate some of the advantages of the English-speaking learners in relation to using ICT, which is English dominated. This applies to learners with English as a HL as well as learners attending English medium schools. One of the possible explanations is the lack of availability of platforms, software and online materials in the other languages, in particular for the isiXhosa-speaking learners but also for the Afrikaans-speaking learners (Gudmundsdottir 2010). This suggestion does, however, not indicate that all learners should be taught all subjects in English. Rather, increased focus should be placed on adapting ICT to the local curriculum, local needs and the linguistic environment of the users. LoLT is an ongoing debate in South Africa and, in relation to use of ICT, is an intriguing topic in need of further research.

Future research could also contribute to understanding the importance of teachers' support and training as they influence meaningful integration of ICT. Indeed, there is a great challenge of building up expertise, and adapting technology to developing countries, particularly the socio-cultural, economic and political environments. At the same time, the importance of an indigenous initiative and the ability to establish, sustain and develop ICT cannot be underestimated and should be included in future inquiries. Based on the findings of this study, the final point to be made is related to the importance of emphasising that future educational reform and policy initiatives need to fully acknowledge the different conditions and realities of learners. As Maldonado, Pogrebnyakov and van Gorp state:

> *the concepts of digital divide and social exclusion are highly interwoven, specifically addressing the multiple dimensions of social exclusion and how they are both a cause*

and consequence of the digital divide is of prime importance (Maldonado, Pogrebnyakov & van Gorp 2006, p.149).

Having a one-size-fits-all policy is bound to have limitations in a country like South Africa where the school realities for learners are so diverse.

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ENDNOTES

[1] *Previously disadvantaged* applies to the black and coloured population of South Africa. It is somewhat misleading to call these learners *previously* disadvantaged as they are in general in a worse economic and social situation than the so-called previously ex-Model C school learners. The ex-Model C schools apply to the previously advantaged and white schools under the apartheid regime. Hereafter, the term disadvantaged will be used without the prefix "previously".

[2] All schools in Cape Town are categorized in quintiles. The quintiles are defined by the location and income of the local community surrounding the school. State subsidies for schools are according to which quintile they are placed in. In the case of this study, Eaglewood was placed in a relatively high quintile because of the school's location. However, the learners in the school did not live in the community surrounding the school but in neighbouring townships. This was certainly unfortunate for the learners as the school fees were higher than the economic capabilities of the learners' families.

[3] A few learners were missing on the days the questionnaire was introduced in the four schools. Additionally, one grade 7 class in Freewill did not answer the questionnaire. The great majority of learners in Freewill had similar cultural and linguistic backgrounds. Having reached 75% of the learners, it was not considered necessary to have the fourth class answer the questionnaire.

[4] Only the learners with English, Afrikaans or isiXhosa as a home language are registered here.

[5] Five learners in Freewill answered that their home language was both English and Afrikaans. In the other three schools, the learners did not answer that they had two languages as their home language. The questionnaire was perhaps not specific enough in specifying learners'

need to report only their main language. It is, however, quite typical in South Africa for homes to use two or more languages.

[6] A public servant strike influenced the last weeks of observations in particular in Xolani, which closed down during the strike. Activities in the other schools were minimally influenced as the teachers stayed home for only a couple of days and then resumed their positions.

[7] Which is the WCED initiative on implementation of ICT in all public schools in the region

[8] This is also confirmed by another research report from the University of Cape Town (Miller, Naidoo & Van Belle 2006).

[9] A few learners in Xolani claimed they had one of the other African languages as their home language. They were recoded and not included in the calculations concerning home language.