

## Analysing the role of ICT in bridging the digital divide amongst learners

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Information and Communication Technology (ICT) is changing every facet of our lives. It is changing the way we do business, the way we live and, more importantly, the way we learn. In this new Golden Age of technology, we see more and more an increasing rift between those who have access to ICT and those who do not. This digital divide can be seen as an educational divide and thus we examine how ICT is influencing education. We also investigate the nature of this digital divide while focusing on the local perspective. A short pilot study was done at four schools and one adult education centre in South Africa regarding their access to ICT. The results are used to indicate how and why ICT can be used in South Africa to overcome the digital divide that currently exists between resource-deprived and resource-advantaged learners. In addition, we examine the implications of the rift and propose a framework for a solution.

### Introduction

The union of information and communication in technology to form the new field of information and communication technology (ICT) has had an effect on the way we do business, live and learn. This union has brought about the Information Age, the New Economy, Information Society or Technological Golden Age.

It is generally believed that Information Age technologies can be used as an important facilitator in the development process of a learner and, in turn, provide a larger range of learned people across the socio-economic divide. In short, ICT has a major role to play in education.

Costello (2000:1) mentions: "The current Golden Age of Technology is being built on a foundation of knowledge. As such, the fuel for the engine of expansion will be an increasingly better-educated populous. And the fruits of this Golden Age will go to those who have the knowledge. In our society, the haves and the have-nots, more than ever before, will be the educated and the uneducated".

The "have and have-nots" mentioned by Costello, describes opposite ends of the digital divide. What one should keep in mind, is that the digital divide describes more an educational divide. According to Herselman (1999), the knowledge gap or digital divide at learner level in South Africa can be seen as resource-advantageous (RA) learners on one side of the spectrum and resource-deprived (RD) learners at the opposite end. Because the resource demand for education is increasing as technology develops, an increasing percentage of the country could find themselves RD learners.

According to Costello (2000), a revolution in education is necessary and the technology that opened the digital divide can be used to radically improve teaching.

Therefore, for the purpose of this study, namely to determine how ICT can reduce the percentage of RD learners, it is important to establish the nature of the digital divide on a local scale — the level of exposure to ICT should be determined among most RD learners. Secondly, techniques or technologies that are employed on both an international and local scale regarding overcoming the problem of the digital divide should be identified as possible solutions to the local problem.

This paper therefore addresses multiple case studies to determine the digital divide situation locally, through the use of interviews with facilitators, and the answering of questionnaires by learners. These case studies originate from culturally disadvantaged communities comprised of four learning institutions, including three schools and one adult learning facility. All learners tested were at pre-tertiary level (Grade 12).

### Defining ICT

We are experiencing the dawn of the new millennium, one that is built

on information and increasing technological advancements. The millennium brings with it a world of greater interconnectivity and an accelerated flow of data, whilst decreasing time and international boundaries. The force driving this rapid revolution in communication, transforming the world from isolated islands to interconnected super-highways is ICT. This section will thus attempt to define ICT and its role in society today.

The Association of African Universities (2000:3) defines ICT as "a shorthand for the computers, software, networks, satellite links and related systems that allow people to access, analyse, create, exchange and use data, information, and knowledge in ways that, until recently, were almost unimaginable. It refers to the infrastructure that brings together people, in different places and time zones, with multimedia tools for data, information, and knowledge management in order to expand the range of human capabilities".

According to Rijsenbrij (1997:2), ICT can be seen as the technologies that support the communication and co-operation of "human beings and their organizations" and the "creation and exchange of knowledge".

Thus ICT is basically previously separate immobile units of data and technologies (IT), incorporated with new communication methodologies and technologies. ICT technologies are therefore part of networked systems, as opposed to older technologies, which were not designed for collaboration with other systems, but focused solely on data processing and the storage and retrieval of information.

The Internet is currently the most important driving force behind the transition from IT to ICT. The Internet, which started in the Defence Force of America as a network for e-mail and file transfer, has now become the public network for everyone. Rijsenbrij (1997) stipulates that, through the Internet, people will be exposed to and incorporate the use of multimedia on their PCs more and more.

Therefore, as a result of these advancements in global telecommunications — particularly in certain countries in the world — there is an emergence of a worldwide network made up of both wired and wireless technologies, with huge transmission capacity. This network manifests itself from an integration of all the forms of telecommunications. These include telephone and cellular networks, Internet and Intranet technologies, as well as entertainment networks (TV, radio, cable, satellite) (Matsumoto, 2001).

In the future these networks, in conjunction with future and emerging ICT technologies, will serve as a global area network that connects Intranets of companies, the home systems of families, possibly the personal computers of individual people and the microprocessors of all types of equipment. To summarise, ICT will have a consequential and ubiquitous effect in the world — especially in the area of education — now and particularly in the future.

Since these are the resources that one has to tap into in order to have access to the fruits that the Information Age promises to bear, one has to identify the "have and have nots", in order to define the digital divide. The next part of this section will look at just what one means by resource advantaged and resource deprived people.

### The digital divide

In nearly every country, it is primarily a certain percentage of people who have the best information and communication technology that is available to society. These people have access to computers and information sources, telephone and facsimile services, Internet services, as well as a wealth of content and training relevant to their lives.

Then there is another group of people. They are the people who, for social or economic reasons, do not have access to computers or even relatively valuable information sources, reliable telephone services, let alone the wealth of information and convenience afforded to one via Internet services. The differences between these two groups of people are what is known as the digital divide. To avoid confusion, in this study the terms RA and RD will be used to refer to the respective groups as defined by Herselman (1999).

To be on the less fortunate side of the divide means that there is less opportunity to take part in our new information-based economy, in which more and more jobs are related to computers. As mentioned earlier, fewer opportunities are provided for RD people to take part in the education, training, shopping, entertainment and communications opportunities that are available to those who have access to the necessary resources. Now that a growing number of people are more regularly making use of ICT to conduct daily activities, people who lack access to those tools are at an increasing disadvantage.

Planting (2000) places emphasis on the possible devastating implications of the digital divide by pointing out that, on the one hand, developed markets could lose the opportunity to develop new markets to trade with and, on the other, the developing world would lose the opportunity to grow. Even worse, there is a risk of an increase in social and economic turmoil that could result from the exclusion of the majority of the world's population from the New Economy. These consequences could harm local, regional and international stability.

Therefore, raising the level of digital inclusion, that is, increasing the number of people who have access to and use the technology tools of the digital age, is of vital importance. So now the imperative and overwhelming task facing both the global and the development community, is finding ways to bridge this divide and wire the poor, whose livelihoods could be enhanced through access to technology. It is evident that these very technologies that are causing this colossal rift are perhaps the very tools that can be used to bridge this ever-growing and urgent divide.

In order to address the purpose of this study, the following section will take a closer look at the ICT technologies that are powering and influencing education in today's information society. It will also draw attention to the possible social negative aspects of these advancements.

### ICT in education and its negative effect

Many strategies and technologies have been developed to help students learn faster, whilst achieving greater retention with much more ease. ICT in all areas of the education world are now being used in ways that are accelerating learning and the capacity of learners at a remarkable pace. Today, accelerated learning and co-operative learning techniques are used with enormous success in large numbers of corporate training programmes and schools that have access to these resources (RA). One often finds that learning time is cut in half. Learning institutions are colloquial to the need to include emerging technologies into their curricula. These techniques — along with distance learning, home schooling, multimedia classrooms and service projects — are also illustrations of how ICT can be used in education (Rijsenbrij, 1997). The following statement by Symons (2000:3) explicitly backs this up: "To prepare students for the New Economy, re-

formers are pushing for a curriculum that uses the Internet, technology and internships to immerse kids in the intellectual challenges they will face after graduation. There is widespread recognition that the world can no longer afford to preserve a system of learning designed for a world that has disappeared".

Much of this study on the use of ICT mentions the potential that such investments offer for humankind. Yet, despite the rhetoric of how ICT can enhance our lives and make us better, more competitive people, the rest of this article will reveal the distressing effect that ICT could have on the people who are left excluded but who have the most to gain through the expansion of ICT in the developing world (RD people).

With wider distribution and transmission of the new technologies come overall adverse consequences. There is an unmistakable confidence that countries with more educated people and scientists will use new ICTs first and will go further faster than countries with fewer educated people (see Introduction). This clearly risks creating an insurmountable chasm between the rich and the poor.

Many developing African countries also feel that western content exports corrupt traditional indigenous cultures which are still an integral part of life in Africa (Heeks, 1999). ICT therefore has the potential to alienate individuals from their past, thus possibly making them dysfunctional for the future.

Some see ICT bringing even greater advantages to the RA, who will overtake the RD even further. There is little to be done to change this trajectory. For some, ICT divergence seems inevitable, favouring developed countries more than developing ones, unless the issue is addressed in a very serious light.

If these are the effects of the digital divide, what then are the restricting factors one has to ponder before devising a solution? According to Heeks (1999), the problem goes beyond just overt resource inequalities, although the most significant can be seen as physical access. This refers to the geographical, material availability the user has to the physical infrastructures (wired or wireless) and to applications and appliances (i.e. TV).

The second restricting factor is financial access, which indicates whether a user has the economic capacity to pay consistently for the ICT services he or she needs. Besides the absence of access, Africa is sorely lacking in the means to provide the resource people with the necessary skills. This can be seen as the third factor, namely cognitive access (Lelliott, 2000).

Besides the lack of infrastructure for both the hardware as well as resource people, one has to — as Lelliott (2000) mentions — point out ICT's capacities of providing an appropriate curriculum in areas like mathematics and the natural sciences which are widely valued for their contribution to a stable economy, yet notoriously ill catered for in schools throughout Africa. This can be seen as content access.

Therefore, in considering the possibility, viability and desirability of ICT as a means of education in Africa, it is crucial to examine how certain interests are served differently by technology in education. The following section will therefore examine the situation locally in order to establish the local RD learners' level of exposure to ICT. This knowledge is important when scrutinising methods that have been utilised both globally as well as in Africa to overcome the divide, in anticipation of a possible solution in South Africa.

### Research done on local situation

In October 2000, the US Department of Commerce released some shocking statistics. According to the report (U.S. Department of Commerce, 2000) over 50% of all U.S. homes have a computer while 41.5% of all US homes have Internet access. The report also revealed that, even though only just over 50% of Americans have access to the Internet from within their homes, access to the Internet is available to fully more than 90% of its population. Of those who use the Internet outside the home, 62.7% do so at work, 18.9% at K-12 schools, 8.3% in other school settings, 9.6% at libraries, 0.5% at community centres, and 13.8% use someone else's computer.

While a great deal of attention has been paid at a cultural level to the digital divide within developed countries such as the US where computers are more often than not readily available to schoolchildren, the digital divide that is equally — if not more critically important — is the one between information-age societies like America and under-developed places like sub-Saharan Africa.

According to the Nielsen/Netratings (2001), there are globally an estimated 429 million people on-line. Even though this may seem impressive, this overwhelming figure is small when considered in context. For instance, the 429 million represents only 6% of the world's entire population. Even more disturbing is the fact that of those 429 million, at least 41% are in North America. Added to this figure is the fact that the United States has more computers than the rest of the world combined. So one can see that when assessed by region, Internet use is dominated by North Americans.

The second highest region is the Asia Pacific Region, where 28% of the on-line population log on. Other facts to consider are that only 27% of the on-line population live in Europe, the Middle East and Africa combined, of which this percentage is heavily dominated by Europe. That means that only 4% of the world's on-line population are in South America (Nielsen/Netratings, 2001).

When one considers what was previously mentioned about the Internet being the fastest, easiest and richest tool for providing information, coupled with the importance of the Internet and the role it plays — especially in education and the emphasis Prof. Kader Asmal (2001) places on the importance of educated people in the New Economy — the implications of the afore-mentioned paragraphs look far more overwhelming than the statistics when viewed from a global perspective.

Therefore this section will examine the research into the local situation as it currently exists in order to discern the resources at hand and to provide perspectives with regard to a solution.

A local study was therefore conducted on 80 Grade 12 learners from various institutions that service the RD communities within the Port Elizabeth area.

### Methodology

Multiple case-study research was conducted. According to Merriam (1988:11), case studies "concentrate attention on the way particular groups confront specific problems, taking a holistic view of the situation". Yin (1994) mentions this when he implies that certain contextual conditions that are highly pertinent to research can only be examined through the use of case studies. Therefore multiple case studies from culturally disadvantaged communities were used to determine the digital divide situation locally. The information needed for scrutiny was extricated through the answering of questionnaires by learners. All learners tested were at pre-tertiary level (Grade 12).

### Sampling

Due to the difficulty in selecting appropriately representative samples, an interview was held with A. Nongauza (pers. comm.), an educationalist within the RD Community and past Rector of the Algoa Training College. Through him, four institutions — three high schools and one adult learning centre — were chosen as fully representing the RD Community in the Port Elizabeth Area. For the sake of confidentiality their names will not be divulged. They will therefore be referred to as School A, B, C, and Adult Learning Centre (ALC).

After having made contact with the respective institutions, the author was given the class lists of all the Grade 12 learners. From these lists, 25 learners were randomly selected from the total sample population for the answering of the questionnaires. Of the 25 learners tested, 20 unspoiled questionnaires were indiscriminately chosen.

### Results

From the selected RD Grade 12 learners tested, one very encouraging result was that 55% of all the RD learners tested had access to a telephone whenever they wanted, although only 35% had a telephone

within their homes. Thirty-four of the RD learners were able to make a phone call when they really had to, whilst only 11% had no access to a telephone at all.

Another very positive finding was that 81% of all the RD learners had access to a television on a daily basis, while the rest, even though they had little contact with television, were not excluded from this technology, leaving 0% having no access to television.

Besides the fact that entertainment networks are important influences in the life of any nation, their role as transmitters of meaningful data is gaining in stature. For example, as a data transmission medium, both cable and satellite have far more capacity than telephone wires. Indeed, computer hardware makers, cable system operators and on-line information providers have devised ways to provide access to on-line information via cable and satellite modems at incredible data rates (Rijsenbrij, 1997).

A disquieting observation, however, was what could be seen as location access. This refers to the distances of prominent community structures from the respondent. Only 29% of all the RD learners had access to a motor vehicle on a regular basis, while 25% had driven a car before, leaving 46% of the RD learners who almost never had access to any motor vehicle.

This was a distressing situation, as most of the RD learners live great distances from their schools, public libraries, post offices and social or community centres. Only 57.5% of the RD learners lived within 3 km of their schools, 18.75% lived between 3 and 6 km from the school, whilst 23.75% lived further than 6 km. Only 36.25% of all the RD learners lived within 3 km of the Post Office; 17.5% lived between 3 and 6 km from the post office; whilst 46.25% lived further than 6 km.

Only 46.25% of all the RD learners lived within 3 km of the public library; 27.5% lived between 3 and 6 km from the public library; whilst 26.25% lived further than 6 km. Only 43.75% of all the RD learners lived within 3 km of the community centre; 12.5% lived between 3 and 6 km from the community centre; whilst 18.75% lived further than 6 km.

Another disconcerting observation was that only 11.25% of all RD learners tested had regular access to a PC, whilst 21.25% had only used one a few times. A full 60% had never used a computer before under any circumstances.

When one considers this, as well as the power of the Internet as a vehicle for information and the resources one needs to be one of the "haves" in this new Information Society, it is even more disturbing that only 5% had access to the Internet on a regular basis, 22% had seen it a few times, while 73% had no real conception of what the Internet is.

Although this may seem like a discouraging situation with regard to immediate access to the Internet, when formulating a solution to this problem one can also look to the fact that 87% of the RD learners had electricity in their homes regularly. Of this percentage over 50% had electricity on a constant basis, leaving just 13% of the learners with little to no electricity resources. Of the remaining 13%, most had access to alternative electricity mechanisms like motor generators. This is especially encouraging, as this resource is the base fuel of all ICT technologies.

The percentage access that learners have to certain ICT resources is summarised in Table 1.

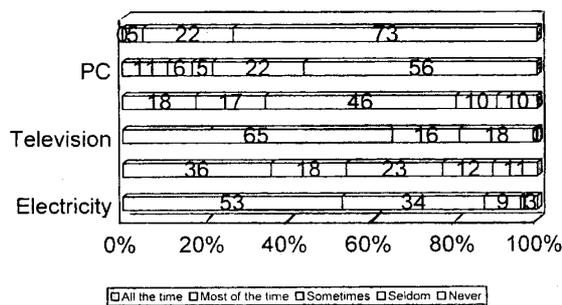
The graph in Figure 1 illustrates the summary of access these learners have to the ICT resources:

From the above it is evident that access to telephones and television is the highest of all resources. Although the above percentages do not add up to 100%, these may be influenced by access on an irregular basis.

As one can see, the situation of the locally tested learners clearly reflects what Herselman (1999) refers to as RD and Costello (2000) refers to as the "have-nots". The situation does not, however, need to be as bleak as revealed. The reason for this is that, as observed, some of the technologies referred to earlier, are already available to the majority of the RD community.

**Table 1** Summary of RD learners' access to ICT in the Eastern Cape

ICT resources	% with access	% with no access	Others not sure
1 Telephone (landline and wireless)	55	11	34
2 Television	81	0	
3 Information centres (library, community)	20 – 35	35 – 46	
4 Personal computer	11	16	29
5 Electricity	50	13	37
6 Internet	5	73	22

**Figure 1** Summary of access to ICT resources

### Overcoming the divide

The solution to this problem can be seen as a staged process, based on information gathered from Costello (2000), Jensen (2001), Lelliott (2000), Planting (2000), the US Department of Commerce (2000) and a model by Heeks (1999), illustrated in Figure 2. The model that was developed illustrates the stages or phases that one has to progress through systematically, in order to devise a solution to any digital divide problem.

Tackling the digital divide in South Africa cannot, as seen from the above research, be as simple as employing methods used in other countries to alleviate this problem because of the unique restricting factors (no access to resources like the PC, electricity and television) as well as those that were revealed by the above statistics.

The first step towards bridging the digital divide, as illustrated in Figure 2, is understanding the divide itself. Therefore one has to be sensitive to certain idiosyncrasies of developing countries.

Some people (Harkins, 2000; Jensen, 2001) indicate that a possible solution of bridging the digital divide may be wireless phones. Wireless phones, more commonly known as cell phones, are changing our culture and the way we think about telecommunications. According to Harkins (2000:2), "Subscriptions to wireless phone services increased by more than 25% between 1998 and 1999 alone. While the number of subscribers has grown at a very rapid rate, the average monthly bill has fallen dramatically". This clearly indicates that access to the Internet via wireless technologies is becoming more and more of a viable option. She goes on to state that it is feasible that — within a few years or less — more people may be able access the Internet through mobile phones or other wireless devices, than through traditional means.

But, as mentioned before, any solution that needs to bridge the divide should be applicable and accessible to RD people. According to Jensen (2001) "large-scale sharing of information resources" is probably the most dominant feature of the African media landscape. According to Planting (2000:2), "We need policy that is pragmatic and that can be implemented — we have had great policy in the past, it's just not always practically achievable".

He says for instance that: "A given copy of any newspaper might be read by more than ten people, there are usually perhaps three users per dial-up Internet account, and it is not uncommon to find most of a small community crowded around the only TV set, often powered by a car battery or small generator". The fact that every single RD learner, even when not having direct access to a television, was still exposed sufficiently to the medium, is also proof of this trait of African media.

So why not shared public Internet terminals? These Internet windows or terminals could be set at strategic places like schools and community centres with customised options that are tweaked to the needs of each individual community. An example in this regard is Kampung Raja Musa, a small village about 120 km south of Kuala Lumpur, where this idea of public Internet terminals was instigated. In its community hall are two kiosks. These are simple, secured, L-shaped stands featuring touch screen computers. Guided by icons, villagers use the terminals to access a database that covers subjects like dressmaking and farm management. Video clips assist users in obtaining the information they need. The ease with which the database can be navigated fulfils a vital criterion: that the terminals be accessible not only to the computer-illiterate, but to the illiterate (Rana-wana, 2001).

Another idea is Telecentres or Community Centre Networks. In 1995, the US Department of Housing and Urban Development (HUD) launched an initiative like this called "Neighborhood Networks". Through innovative private/public partnerships, these neighbourhood networks, set in lesser-advantaged communities, establish multiservice ICT centres that bring digital opportunity to communities where there is normally a lack of these resources. There are more than 800 of these neighbourhood networks centres operating in HUD multifamily housing properties throughout the United States, including the District of Columbia and Puerto Rico (U.S. Department of Housing and Urban Development, 2001). These centres are tailor-made to fit each local community and open the doors — both on-site and via the Internet — to a large number of job opportunities, social services, micro-enterprise possibilities, and educational programmes for the communities they reside in. If these centres are adapted to local RD communities and applied in strategic positions within these targeted communities, these hubs or beacons of information could prove to be a suitable solution, especially in communities where schools, libraries and post offices are incredible distances from within reach.

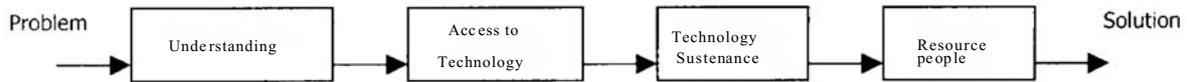
This does not mean the government does not need to do its part through various Internet and Broadband initiatives. Anikulapo (2001) stipulates this when he says: "The way to overcome these social, financial and technological stumbling blocks is for African political leaders to initiate projects and develop programmes that would lift their people out of the abyss of poverty and empower them to compete with people from other continents, rather than wasting resources on frivolous projects that do not benefit their people" (Anikulapo, 2001:3).

Whilst these may be ways of bringing the Internet to RD communities and thus providing access to Technology, the authors believe that what these communities need, is an Internet future that involves the serious integration of the television and other electronic entertainment media with the computer and Internet. As research has shown, there is a tendency to prioritise access to media for entertainment like television, before education. We should not ignore that tendency, but grasp it and use it as an advantage.

### Conclusion

As mentioned before, technology has been too expensive, too complicated or too outside everyday culture for most RD people — that is the basic problem, because, as mentioned earlier, technology influences education, which (in turn) has an adverse effect on who are the "haves and have-nots" of this new Information Age.

Therefore it is imperative that new products, ideas, applications and standards should be set to construct at least a rope bridge over the digital divide. These on their own need not immediately bring every-



**Figure 2** The digital divide bridge

one all the way up to speed in technology access, but each will be a surefooted step in that direction.

One must understand that the information revolution offers Africa a dramatic opportunity to leapfrog into the future, breaking out of decades of stagnation or decline. Africa must, however, quickly seize this opportunity by applying, as we have seen, innovative and truly African solutions to our global digital divide problems. If African countries cannot take advantage of the information revolution and surf this great wave of technological change, they may be crushed by it.

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