# From zero to hero – is the mobile phone a viable learning tool for Africa?

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## ABSTRACT

In many countries mobile phones are being banned from schools amidst growing concerns regarding their inappropriate use during school hours. However, the mobile phone is the de-facto most important networked knowledge exchange technology used in Africa and the most powerful universally-accessible computing device in the hands of Africans. How do we change the perception of the mobile phone as a disruptive influence in schools to one where it can be used to pragmatically support the learning process? MobilED (Mobile EDucation) is a 3-year international collaborative project aimed at creating meaningful learning environments using mobile phone technologies and services. The MobilED project was initiated in South Africa and the first two pilots consisted of exploratory research into the use of mobile phones in an advantaged private school and in a poor government school in Tshwane, South Africa. This paper examines the viability of the mobile phone as a learning tool in schools in Africa by using the MobilED project as a case study. It discusses the current anti-mobile phone situation in many schools in South Africa and suggests possible strategies to harness the potential of the mobile phone in practical ways as a pedagogically-appropriate learning tool in schools in Africa.

## KEYWORDS

mobile learning, mobile phones, developing world, South Africa, Africa, learning scenarios, ICT, school, technology platform, computing device, audio-wikipedia, text, SMS, search term, Wikipedia, speech synthesizer, information society

## 1. INTRODUCTION

The United Nations Secretary General, Kofi Annan, on World Telecommunications Day, May 17, 2004, told the world: "Today, many people could not imagine daily life without the use of increasingly sophisticated information and communication technologies (ICTs), from television and radio to the mobile telephone and the Internet. Yet for millions of people in the world's poorest countries, there remains a digital divide excluding them from the benefits of ICTs" (United Nations, 2004).

Although South Africa is a country where there are pockets of first world environments, it is still largely a developing country with the typical problems and issues experienced in such contexts. It is an environment where affordability, accessibility, limited electricity supply and lack of infrastructure has led to a general lack of ICT-literacy amongst the majority of people. According to the School Register of Needs (Department of Education, 2000) survey, of 27 148 schools, only 58 percent had electricity, 55 percent had telephones, 30 percent had computers, and 16 percent had access to the Internet.

However, the advent of the mobile phone is set to have a major role as a catalyst for the information society as well as the narrowing of the digital divide in South Africa and the rest of Africa. According to the International Telecommunications Union, Africa's mobile cellular growth rate has been the highest of any region over the past 5 years, averaging close to 60% year on year. The total number of mobile phone subscribers continent-wide at end 2004 was 76 million (ITU Report, 2006). The economic and social benefits of mobile phones are evident at all levels of society and the penetration rate of mobile phones is significant, especially given the fact that access is often shared (Vodafone Policy series, 2005).

Even with all the positive aspects of the rapid adoption of the mobile phone in developing countries, many of the negative issues are receiving a lot of popular media coverage in South Africa. Many schools in South Africa are either banning mobile phones from school premises, or locking them away during school hours. A popular instant messaging service, known as "MXit" which enables text chatting via mobile phones at a fraction of the cost of normal SMS messages, has taken the youth of the country by storm, with more than 3 million users, of which 45% are in the 14 – 18 year-old age-group (News24, 2007). Media reports state that this has led to inattention in class and the exposure of teens to sexual predators. In addition, mobile phones are also being used to videotape violent fights between children in schools and there are reports of children distributing pornography via their phones (Mail & Guardian Online, 2006). This is reminiscent of the early days of the internet in the 1990's and many of the debates currently happening in South Africa about the mobile phone are similar to the debates that happened and are still happening in the developed world. The issues exposed by MXit are identical to those of the popular social networking platform, MySpace – the main difference being that mobile phones are the device of choice in the third world versus the ubiquitous networked computer in the first world.

Despite the controversy about the use of mobile phones by children, the reality is that modern mobile phones are very powerful computing devices, with built-in advanced multimedia facilities. In addition, if we have a closer look at the whole mobile phone infrastructure we will realize that the actual device can be seen as a terminal for using several computers in a network. When making a simple call or sending a SMS message we use (1) the "computer" of the mobile phone, (2) server computers of the operators and (3) the "computer" of the receiver's mobile phone. When mobile phones are perceived as terminals for using computers we open up a new perspective for design and development of practices on how mobile phones could be used in different human operations and processes, including formal learning. Additional important considerations for using mobile phones as potential learning tools include features such as limited or no dependence on permanent electricity supply, easy maintenance, easy to use audio and text interfaces, affordability and accessibility (Masters, 2005; Mutula, 2002; Stone, Lynch, & Poole, 2003). MobilED (Mobile

EDucation) is a 3-year international collaborative project which attempts to link these features to the way mobile phones are used in informal learning contexts and builds on the advances made in the psychology of learning, which emphasize the collective nature of human intellectual achievements and the use of the mother tongue in the learning process (Ford & Leinonen, 2006).

The MobilED project was initiated in South Africa and the first two pilots consisted of exploratory research into the use of mobile phones in an advantaged private school and in a poor government school in Tshwane, South Africa. The pilots were undertaken in an increasingly hostile environment towards mobile phones in schools.

The outputs for Year 1 (2006) were a set of learning scenarios that have been successfully tested in schools and a prototype MobilED technology platform to support these scenarios. Year 2 (2007) is looking at how to build on the early successes, whilst expanding the platform and technologies. A big focus for the project is the challenge of making such an intervention sustainable in schools in South Africa (and Africa) and moving from a piloting to a mainstreaming approach.

## 2. RESEARCH FRAMEWORK

The approach of MobilED is to integrate research-based ideas of using mobile technologies in teaching/learning with active scenarios of real learning programs. The project includes the design, development and piloting of prototype applications where multimedia and language technologies (voice, text, images) will be used via the mobile phone as tools in the learning process.

The partnership consists of a collaboration between the Meraka Institute of the CSIR, Tshwane University of Technology, University of Pretoria (all South Africa), the Media Lab of the University of Art and Design Helsinki (Finland), Escola do Futuro Universidade de São Paulo (Brazil) and the WikiMedia Foundation (United States). For the pilots in 2006, handsets were donated by Nokia.
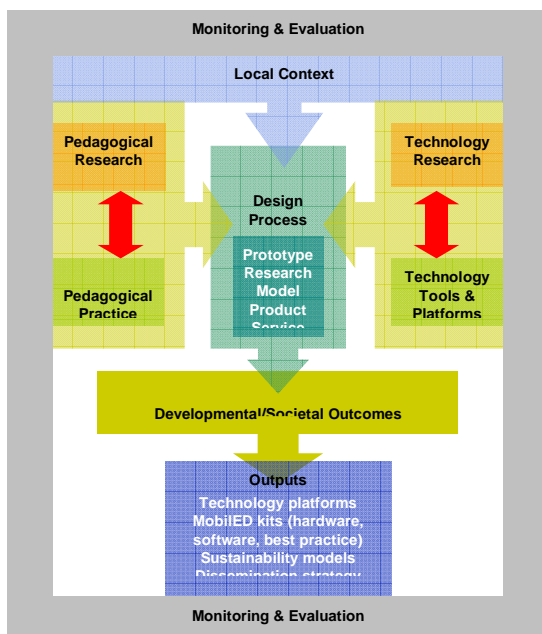


*Figure1: MobilED research framework*

The strength of the multi-disciplinary nature of the partnership as well as deep roots in cognitive, learning and design sciences lends a multi-pronged perspective to this initiative. In order to ensure cohesion and understanding between the different disciplines (which includes educators, educational researchers, educational psychologists, designers, software engineers and electronic engineers) a research framework was developed and is shown in Figure 1.

Each intervention needs to grounded in the local context. Central to the intervention is the design process, which is fed by both the appropriate pedagogical models and the potential of the technology itself. Since South Africa is a developing country, any intervention needs to take cognizance of the developmental and societal outcomes. (Ford & Leinonen, 2006). We are employing the *Outcome Mapping methodology* (as designed by IDRC in consultation with Dr Barry Kibel of the Pacific Institute for Research and Evaluation as an adaptation of the Outcome Engineering approach).

The research followed a mixed methods approach, making use of both quantitative and qualitative methods in collection and dissemination of the generated data.

## 3. MOBILED APPROACH

The approach taken in the school pilots was to build on the way mobile phones are used in informal learning contexts, by applying some of the techniques to a formal school environment. In our everyday use of mobile phones, we call our colleagues and friends to seek information and reciprocally help them in their knowledge acquisition and problem-solving situations. Simultaneously, we build up our social networks and strengthen the links that are considered very important in modern theories of learning (e.g. Senge 1990). In African traditional culture **'Umuntu ngmuntu nga bantu'** means literally, 'a person is a person because of other people'. In other words, 'you are who you are because of others'. Expressed variously as **'Botho'** in Sotho and Tswana and **'Umbabtu'** in the Nguni languages, this concept is about a strong sense of community where people co-exist in a mutual supportive life-style. This approach of using community-based knowledge systems is particularly applicable in the African context.

MobilED thus seeks to create technology that supports existing social infrastructures and increases the potential of current practices with mobile phones by introducing new opportunities for knowledge sharing, community-building and shared creation of knowledge in the authentic context of studying and learning. With this technology the participants may be encouraged to increase the value of their current practices through knowledge sharing and collaboration across boundaries of time and place. Freedom from the constraints of time and place enable the timely use of technology wherever knowledge acquisition and problem-solving are situational and contextual (Ford & Leinonen, 2006).

As South Africa is a developing country, the focus is particularly on those schools that have limited access to learning support and reference material (either using the internet or via traditional paper-based libraries), and teaching resources (teachers and text books). Although the project is not limited to these environments, this objective will always enjoy priority (van den Bergh & Aucamp, 2007).

From a technology perspective, all tools and platforms developed will be made available as Open Source Software

(OSS), in support of the collaborative, knowledge-sharing philosophy of the project. Probably the most important benefit of Open Source Software is that it stimulates the local IT sector in a country, which is crucial in developing countries to ensure full participation in the information society. From the social angle, OSS is highly beneficial because it allows software to be customised to local conditions by the communities themselves (Go OpenSource, 2006).

## 4. THE PLATFORM

It was decided to start with technology that is readily available in the poorest communities of South Africa. Although there is a very high level of mobile phone penetration in South Africa, the phones only have very basic functionality (RNCOS, 2006). This influenced the decision to base the first phase of the project only on voice and text (SMS) capabilities of mobile phones.

The first learning scenario developed consisted of a prototype mobile audio-wikipedia. The MobilED audio-wikipedia utilises the basic texting capabilities of mobile phones and enables the user to send a text message (SMS) with a search term to Wikipedia. The server responds to the user-initiated query with a return call where the article is read using a speech synthesizer. The user can navigate through the article using the phone keypad and may also add information by dictating content over the phone. The voice file is then appended to the article, for other users to access. This gives a user in Africa without access to a traditional computer connected to the internet the opportunity to use a very basic mobile phone to both access and contribute information to the body of knowledge, thus becoming a fully-fledged member of the information society.

Based on the scenarios developed, the technology development team built version 1 of the MobilEd platform. MobilEd employs three main technology platforms to achieve its goal (Aucamp, 2006):

- An SMS communication interface/gateway, such as Kannel (http://www.kannel.org) or Alamin (http://www.alamin.org/) to send and receive SMS's,
- the Asterisk Open Source PBX (http://www.asterisk.org/) for audio telephony communications, and
- a MediaWiki (http://www.mediawiki.org/) server with suitable content, such as en.wikipedia.org

A typical high-level use case of the system is provided in Figure 2, below.
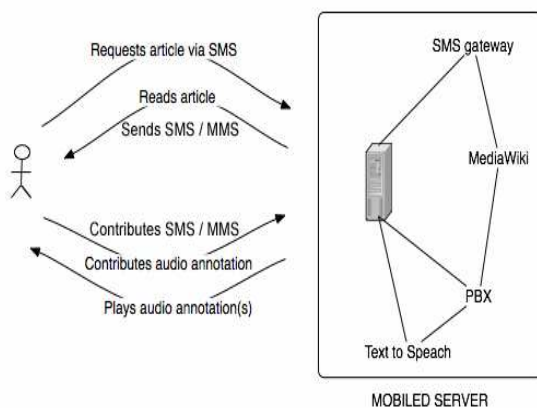


*Figure : Simple high-level usage scenario (user's perspective). (Aucamp, 2006)*

## 5. THE PILOTS

In the pilots the topic of investigation was HIV/AIDS. Various social aspects around AIDS were explored and investigated by the learners in an effort to explore and add to our rich "African Philosophical Thinking" and to promote sensitivity across a range of social contexts, cultures and races (Batchelor, 2007). The lessons were designed to be part of a two-week learning event and were classroom-based. Two double and a single lesson were used for the intervention, which involved 4 hours of contact time. Learning was group-centred and inquiry-based using the Jigsaw cooperative learning technique (Aronson et.al, 1978). The aim was for each group of learners to create an "audiocast" containing information about HIV/AIDS from their own perspective to their peers.

As part of the pilots, a MobilED "kit" was conceptualised. It consisted of a box containing:

- one mobile phone
- a set of speakers to amplify the audio received via the phone
- optional earphones
- electrical sockets for charging the phone
- instructions on how to use the MobilED service

All objects were colour-coded with stickers, and placed into a corresponding container to make distribution and control easier. The reason behind the compilation of the kit was that in an under-resourced environment, in a class of 30+ learners, the kit could be used with ease during collaborative learning events with easy assembly, charging and storage in a lock-up facility for safekeeping (Batchelor, 2007).

### 5.1 Pilot 1

It was decided to run the first pilot in a private school, where learners are from an affluent community and are fully technology-literate, since there was a need to test the first version of the platform. The results would then influence the design of a further, more advanced version of the platform (and learning design) which would be piloted in a poor, disadvantaged school.

The learners were very enthusiastic and supportive of the concept throughout the pilot period. Research questions were grouped together in themes and included those related to the group interaction, access of information, text-to-speech voice, reaction of the service, service settings and audiocastings.

Some of the results of the pilot are listed below (Ford & Botha, 2007).

- It was not necessary to "teach" the learners how to use a phone – it was an everyday skill that they had already mastered. Although these learners did not like the fact that the phones were shared in the group, the use of shared phones with speakers supported collaboration towards the shared task and video data shows that peer learning and support took place.
- The boys tended to "dominate" the technology usage.
- Learners were uncertain about the synthesized voice. Feedback was that the voice was very difficult to understand and that the speakers didn't work very well.
- The learners were enthusiastic about the (legal) use of mobile phones in the classroom and enjoyed the audiocasting experience.

- An unexpected consequence of the first pilot was that because of the positive experience from all involved, the school requested another pilot. Although this was not planned as part of the original intervention, an additional pilot (Pilot 1A) was run. In this pilot learners went on a trip to a theme park as part of a science lesson on energy. All interactions between the teachers and learners were via SMS. Some content was "seeded" on a wiki and the MobilED platform was expanded to include information retrieval via SMS as well. The learners used their own mobile phones and there was spontaneous sharing of mobile phone capabilities (such as photos, audio and video).

## 5.2 Pilot 2

Pilot 2 was run at a local government school. The learners were from very poor backgrounds and most travelled long distances from outlying rural areas on a daily basis to get school. Most learners did not own their own mobile phone, and many had never used a mobile phone. Although the school did have a computer lab, the computers had been stolen and the learners were not at all ICT-literate. The learners do not speak English as a home language, but are educated in English from Grade 6.

The learners were given a longer period of time to familiarize themselves with the mobile phones and they were also given a printout of a typical Wikipedia article. Since very few articles exist on Wikipedia in their home languages (Sepedi, Setswana, isiZulu), the lesson was given in English.

The experience for the learners during this pilot was once more very positive. In scripting and practising their audiocastings, a lot of indigenous song was used to contextualize their script. Their castings contained a lot of excitement, and some were very emotional in their recordings. The heightened emotions can be relayed to the topic of HIV/AIDS and their own personal experience of this disease (Batchelor, 2006).

Some results were as follows (Ford & Botha 2007):

- The teachers and learners wholeheartedly supported the concept. Learners were motivated and energized and clearly enjoyed the learning process. Whereas in the private school, teachers were conscious of the negative aspects of mobile phones in schools and were cautious in their approach, in the government school teachers wholeheartedly supported the MobilED concept. This can be attributed to the fact that most learners in the private school already had access to mobile phones and that there had already been some misuse of these phones in the school environment. In the government school, teachers had not yet experienced problems since the vast majority of learners did not have personal mobile phones.
- The teachers needed a lot of support to develop the lesson plans, and depended a lot on the work done in the previous pilot.
- Many of the learners spontaneously used the tool to find out information about other topics that they were currently studying. This was evidenced by the server log data recorded.
- Although the learners were not ICT-literate and very few had access to mobile phones, they took a very short time to familiarize themselves with the technology. For example, they discovered that the mobile phones had FM radio capabilities, and before long they had tuned in to the local radio station. They also discovered the games on the phones.
- Since many mobile phones are shared in their culture, they did not have a problem with sharing the mobile phone during the lesson and enjoyed the collaborative aspects of the tasks.
- It was interesting to note that the boys did not dominate the technology as in the previous pilot – there was equal use by both sexes.
- They were also less critical of the artificial voice (which had been improved in the interim).
- They said in interviews that they preferred using English as their language of choice for learning. They see English as the "academic" language and the gateway to opportunities later in life. It was interesting to note that interactions between participants were in their home languages, but most produced audiocasts in English. They were excited that their contributions could potentially reach a huge audience worldwide. It was obvious, though, that using English as the language of instruction was a major problem for some of the learners, as evidenced by the written responses to some of our questionnaires, which were in poor and broken English.

## 6. FROM PILOT TO IMPLEMENTATION

Although it is still early in the piloting phase, one of the deliverables of the project is to develop potential sustainability and business models for full implementation of MobilED in schools in South Africa. The need to support learning with appropriate ICTs in Africa is urgent – in our environment we cannot afford to only undertake academic research - learning from such pilots needs to be applied into real world environments. Over the next year, specific focus will be placed on a model for the "massification" of this technology. This model has to take cognizance of the current anti-mobile phone situation in schools. Some of the questions regarding mobile phones as learning tools are addressed below.

*Is the mobile phone a viable learning tool? Isn't the screen too small to be useful?*

The pilots clearly showed that mobile phones could be used constructively during the teaching and learning process in a formal school environment. The barrier of entry was very low - the learners themselves were very open to using the technology and the teachers could focus on facilitating the learning process, rather than having to grapple with new, unfamiliar technologies (as is the case with traditional computers). Thus both learners and teachers felt empowered and confident in using the phones as learning tools.

The pilots showed that there is a need to change the perceptions of using mobile phones in schools. They should not be seen as *only* mini-computers, and used in a similar fashion as a traditional computer. The focus should be on the strength of the device as a communication medium (whether using text-based or voice-based capabilities) to support learning paradigms such as social constructivism and problem- and inquiry-based learning. Our results did show that there is a need to provide some support to teachers with regard to employing mobile phones in learning situations. One of the methods in which this could be done is to extend the MobilED kit to include pedagogical guidebooks with descriptions of learning events, some reusable physical "learning objects" (e.g. laminated paper sheets) that will help teachers and learners implement mobile

learning events, and a DVD with video footage of example projects. The MobilED kit could be part of the school's facilities, just like blackboards, overhead projectors, computers, etc. When a teacher wants to implement a mobile learning project it will be easy to take the MobilED kit to the classroom and when the project is over to return it to a secure environment (such as the teacher's room or school library).

Since a mobile phone is a portable device and can be used anywhere, anytime – the teacher does not need to take her learners to the technology (as per the computer lab model), but is able to take the technology to the learner – it also opens up the possibility of using the technology on field-trips and out of typical classroom environments. In the developed world a "socially and educationally responsible definition (of mobile learning) must view the learner as the one being mobile and not his/her devices" (Laouris & Eteokleous, 2005). This is a distinct advantage of employing mobile learning in the developing world - however, issues such as accessibility and affordability are still the main drivers. If we separate "mobile learning" into "mobile" and "learning", the "learning" aspect is the most important concept in the developing world.

*What about cost implications?*

Since the mobile phones used in the first pilots were basic models and only needed to support the ability to send an SMS, the cost factor for the handset was small. However, the network costs (sending an SMS and providing the content via a phone call) could become prohibitive if the service were to be provided widely in South Africa and Africa. It seems obvious that some kind of support would be needed from the mobile network operators in the various countries where MobilED could be implemented. One possibility is to give schools free or discounted rates for the educational use of mobile phones. There is already a special e-rate specified in the South African Schools Act, 1996 (Act No. 84 of 1996). This e-rate gives schools Internet access at a 50 percent discount. There may be a possibility of including mobile learning in the definition of the e-rate.

Other technologies which can cut costs include Voice-Over-IP solutions and other GPRS-supported services, such as the instant messaging service, MXit. In South Africa the cost of mobile data services is much cheaper than voice-, SMS- and MMS-related services and the situation is similar in other African countries.

All these options will be investigated in detail over the next 2 years.

*How do we reverse the current negative public opinion on mobile phones in schools?*

There is no question that currently there is a lot of "under the table" use of mobile phones in classrooms and that they are distracting influences. This came out very strongly in many of the interviews held while we were collecting data for MobilED. However, our approach is to educate teachers, learners and parents with examples of the positive use of mobile phones in a learning environment. We have therefore embarked on a series of interviews with the media where we are describing the pilots and are giving examples of how mobile phones could be used in pragmatic, positive and meaningful ways to support education.

One of the first mobile learning projects, M-learning (funded by the European Commission, the project partners and the UK Learning and Skills Council), which started in 2001 was instrumental in exploring the concept of mobile learning.

Before that time they found that few people could even envisage the potential of mobile devices for learning (Attewell, 2005). In M-learning they did experience excessive use of devices for non-project activities and when this occurred they temporarily blocked phones and issued warnings that resulted in improved behaviour. In the MobilED project there were no similar cases (other than the phones being used to access other learning material). Learners were each given a fixed amount of airtime and they were expected to complete the assignment within that restriction.

M-learning also only had one reported case of inappropriate use of a device to access a pornographic website. At that stage the access to these sites, but recently the tools necessary to restrict website access have become available (Attewell, 2005). It is therefore possible to control such a mobile learning environment, if a school finds this necessary.

We have also found that the schools themselves are the best champions for mobile learning. Cornwall Hill College, the private school in which MobilED's Pilot 1 was undertaken, has embraced the idea and is involved with various of their own mobile learning pilots.

*What about health and safety issues for children using mobile phones?*

There are concerns with regard to the safety of children carrying mobile phones. One potential solution would be to store the phones at schools in a secure facility. This would not be the ideal situation, since it would hinder the use of the phone in out-of-school learning environments (such as using it as a tool to support homework).

The health issues regarding mobile phones are also still quite controversial. M-learning (Attewell, 2005) reports that the UK National Radiation Protection Board's (NRPB) independent Advisory Group on Non-Ionising Radiation (AGNIR) examined recent experimental and epidemiological evidence for adverse health effects caused by exposure to radiofrequency (RF) transmissions, including those associated with mobile telephone handsets and base stations. AGNIR has concluded that there is no biological evidence for mutation or tumour causation by RF exposure, and epidemiological studies overall do not support causal associations between exposures to RF and the risk of cancer, in particular from mobile phone use. AGNIR found a number of studies that suggested possible effects on brain function at RF exposure levels comparable with those from mobile phone handset use. However, AGNIR regarded the overall evidence as inconclusive (Attewell, 2005).

*How could a school institutionalize mobile phones as learning tools?*

After the pilots, Cornwall Hill decided to champion the use of mobile phones in their school and started developing a strategy for institutionalizing the phones. Additional work needs to be done, but some of the results are discussed below.

Because mobile phone use is difficult to monitor in a classroom setting, the appropriate use of these instruments can be encouraged through values-based principles, instead of managing it on a rules-based system. Values must be clearly defined, understood, communicated and practiced. Individual responsibility and accountability can be stipulated and its acceptance is to be encouraged amongst all stakeholders. Well-established communication channels can also ensure well informed participant behaviour.

Developing a clear strategy for the formal use of these instruments to facilitate learning is paramount to the success of adoption. This strategy can be divided into three different phases. The first phase focuses on creating awareness amongst the various stakeholders in a school setting. This can be achieved by creating an atmosphere of informed curiosity by running pilots and publishing the results in a local and global context. The second phase consists of an adjustment and developing phase where competencies are identified and policies drafted. It is crucial at this stage to offer support to those who want to come on board to keep the momentum and growing interest going. The final phase involves the identifying of mentors to coach and form ongoing relationships with those already involved in the initiative. Their role is to have a clear understanding of organizational context and to give advice on how to move forward.

The crucial factor in determining successful implementation of new strategies is to create cause champions in the process. It is the role of the champion to demystify the mobile instruments and to create an environment in which it can be viewed as just another tool in the toolbox of the educator to help them in their efforts to facilitate lifelong learning.

## 7. CONCLUSION

It is our contention that the mobile phone could be the de-facto ICT learning tool in Africa. Although there have been negative experiences with regard to mobile phones being misused in schools, we believe the vast potential of mobile phones integrated into the learning process outweighs this, as demonstrated by the first two pilots of MobilED. Rather than banning the device in schools (and sending it "underground"), we suggest that schools embrace the technology. It is a way of reaching today's generation in a medium in which they feel comfortable. Schools and parents need to be aware of the pitfalls of the digital world and the onus is on them to support and prepare learners to be digital citizens. Prensky (2005) puts the issue quite succinctly:

*"Educators have slid into the 21st century — and into the digital age — still doing a great many things the old way. It's time for education leaders to raise their heads above the daily grind and observe the new landscape that's emerging. Recognizing and analyzing its characteristics will help define the education leadership with which we should be providing our students, both now and in the coming decades. Times have changed. So, too, have the students, the tools, and the requisite skills and knowledge. Let's take a look at some of the features of our 21st century landscape that will be of utmost importance to those entrusted with the stewardship of our children's 21st century education."*

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