Is there a role for Information and Communications Technologies in rural schools and their communities?

Conference or Workshop Item

Is there a role for Information and Communications Technologies in rural schools and their communities?

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This paper is part of work in progress.

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http://www.nelsonmandela.org/ (Rural Schooling)

Story 1: This was a very rural school. It was our first visit. By the time you arrived, you hoped it wasn't going to rain because it would be difficult to drive out on a rainy day. A company had donated a top quality set of computers to this school approximately 12 months before. I sat down with the entire staff team and asked them to tell me about the school. They began to tell me everything that they did wrong. They spoke softly, emanating a sense of failure. I asked them about what was going well at the school – a small thing that made them proud. They looked down. The principal said she could not think of anything. I started asking about the computer lab. They said they had received the donation. They said they were extremely grateful. They said that they knew that computers made a good school. They said that the community had started to send their children to this school in more numbers, seeing now that the school would be 'high quality'. They had received a small amount of training in a nearby town. There was a generator that could light a small city that they feared to turn on. We went to the computer lab, and all of the computers were still wrapped in plastic. We went to the generator and showed them how to turn it on. We then turned on all of the computers, and the software seemed to be loaded properly. Finally opening up, they talked about the heaviness of what they carried. They said that the relationship between the community and the school had reached a low. Parents blamed teachers for having 'everything that is needed' to provide a high quality education, and still they were 'failing'. As we were pulling out, the teachers asked us if we could please turn off the computers. They were convinced that they might break them if they turned them off themselves.

Story 2: She was a teacher. She said the problem was with the training. And the problem was with the idea of a 'champion.' She said that businesses liked to make donations of computers to schools. But they did not like to provide funds for extensive training. And so they would identify the 'computer champion' at each school. A computer champion could be the person with some experience with computers, or it could be the person who was the most excited, or it could just be any person for any reason. They would be sent usually on a one-week computer literacy course in a nearby town – maybe Mthatha, maybe East London. She said that maybe you did understand while you were sitting in that course. She said that then you came back to your school and were supposed to be the 'champion', and to train others. Meanwhile, when you pushed a button in Mthatha a certain thing happened. When you came and tried it on your own, it did not quite work out the same. If you barely understand yourself you are not going to be a champion. And there starts the problem. It becomes a frustration rather than a good thing.

Story 3: Several of the schools had received computers from independent private sponsors over the past two years. We went to visit to understand the experience. Of 9 schools we visited, 4 of them had outsourced the 'computer training' to town-based 'consultants' who charged learners R100 or more per month to participate in the training. The children who could not afford left school early on 'computer' days.

Story 4: He was a principal of a secondary school. A company had made a donation of several top quality computers at his secondary school. No one in the school went for training. He kept the keys, and would not allow anyone to use the facilities. After training was provided, he still kept the keys. The educators said that simply put, the computer centre was not used. In the next meeting he described how terrible the relationship was between the school and the community. He said that the only solution was to get more computers. He said that the community loved computers, and if there were more in the school it would make him look like a good principal.

Story 5: We were in a meeting focusing on ICT in schooling, with an organisation doing some of the most important planning for the provincial Department of Education with reference to ICT. They were reflecting on the poor skills in rural schools to support ICT investments. They began discussing an 'ICT Champion' at a well-resourced urban school serving a mixed student population, within a middle-income community base. They were saying that 'if only' this 'type of person' could go to rural schools, then ICT investments had a good chance of becoming productive.

Story 6: This educator taught in Butterworth. She was one of the lead teachers considering mobile technologies in the context of her school. She engaged with the progarmme deeply and with colleagues developed many ways in which she could effectively integrate ICT into learning within the classroom using a laptop. After the intensive programme she participated in a number of video conference calls with colleagues in the UK. When she heard of the resistance some teachers in the UK showed toward ICT developments, she said that educators in the UK must learn from their colleagues in Africa about the potential for ICT in education

Introduction

> *How are we going to overcome poverty? ….. perhaps the answer lies in our ability to replicate the best elements of our society, at all levels, and among all communities*. (Nelson Mandela, 1999).
>
> *Let it be clear that technological development must be one of the concerns of the revolutionary project…critically viewed, technology is a natural phase of the creative process which engaged humans from the moment they forged their first tools and began to transform the world for its humanization*. (Paolo Freire, 1972).
>
> *'The relative success of educational change in middle class schools combined with abiding shortcomings in service delivery in schools catering for the poor is beginning to reveal a fragmentation of the education system in South Africa. This trend needs to be arrested by applying strategies that are focused on ensuring that the policy frameworks have the desired impact on education outcomes for the poor.'* (ANC 51st National Conference: Social Transformation: Fighting poverty and building a better life, 2002)

There is a lot of talk about the potential of Information and Communication Technologies (ICT) for the transformation of rural schooling in Africa. Despite more than a decade of significant investments in ICT worldwide to benefit education (including in South Africa), important gaps remain in the current knowledge base about the use of ICT in Education (InfoDev, 2005). In addition there is little empirical research on the particular experiences of rural and impoverished communities in the use of ICT for teaching and learning. Further, the debate about 'ICT' in rural schools is largely polarized into two camps – the skeptics who claim that ICT is totally irrelevant to the cultural and economic context of the rural poor and the praise singers who assert that 'computers' represents the promise of 'leap frogging' rural schools into notions of educational quality.

This paper seeks to problemmatise these camps, and to indicate a more complex starting point – one that suggests that we can neither afford to ignore the possibilities of new technologies for rural and poor schools, nor can we look away from the forces at play that threaten to further erode the agency and possibility of rural schools, and deepen the divide between affluent and non-affluent centres.

This work is a synopsis of a longer work in process (Porteus et al forthcoming, 2006) which draws deeply on the findings of a range of research activities carried out by a small team from the Nelson Mandela' Foundation's Unit for Rural Schooling and Development, based at the University of Fort Hare, South Africa and the Digital Education Enhancement Project (DEEP) based at the Open University, UK:

First, an evaluation of the experience of a group of rural 'ICT' schools in the Eastern Cape, South Africa working within the framework of donated school 'computer labs'. This research was carried out in October 2005. The experience, in its promise and pain, we argue holds important lessons for the role of ICT in rural communities;

Second a pilot project, *Inkanyezi*, undertaken by a partnership between the University of Fort Hare and the Open University (UK) between 2002 and 2004 which involved 12 (mainly rural) schools in a programme which consciously considered the relationship between experiential pedagogy and mobile technologies. Many participants are still working together in a community of interest.

Third, a literature review focusing on ICT and education in the South,

and *Fourth*, 23 'expert witness' interviews carried out between Ocober 2005 and March 2006. Expert witnesses were selected as key actors or opinion formers in the public, private or civic sector in respect to ICT in education. They consisted of learners, educators, activists, researchers, policy makers, ICT specialists, and donors (see http: www.open.ac.uk.deep/podcasts).

Objectives

The objective of this research is to critically reflect on:

- the interface between 'information and communication technologies' and rural and poor schools in the Eastern Cape;

- the experience and research of other ICT innovations, as well as the literature focusing on the use of 'information and communication technologies' in rural and poor schools;
- the experiences of teachers using ICT in rural schools in confronting the question – is there is a role for ICT in rural schooling?

by reflecting on these questions we wish to

- stimulate dialogue about the relationship between information and communication technologies and rural schooling in such a way that might provide the basis for more effective practice.

Theoretical Starting Points

Several theoretical biases inform this work – *critical theory, neglected experience and voices*, and a particular approach to *social change*. They are set out in more detail in the longer version of this paper (Porteus et al. 2006).

We use *critical theory* to continually remind ourselves that the way things appear superficially in the world may distort their real historical meaning. In the context of the agenda of the previously colonised South, such theory keeps us mindful of a 'decolonising' agenda and poses the question of how any intervention, despite its intentions, can contribute to a re-colonising project.

The current discourse surrounding 'information and communication' technologies in schooling is polarised into narrow streams. As we will illustrate in the research reported below, a dominant discourse has emerged from global capital, suggesting that 'information and communication technologies' (primarily defined as 'computer labs') represent the only hope for educational quality in the South. Competing with this discourse is a much weaker (but arguably strengthening) discourse emerging from educators, suggesting that ICT investments in school can only succeed if seen exclusively through the lens of educational considerations, and particularly educator pedagogy and practice.

The authors of this paper argue that one of the most important contestations in relation to ICT in schools is to significantly strengthen the neglected experiences and voices of educators, over the discourse of technicians and global capital. This research is therefore strongly informed by an emphasis on both *the voice and experience of the rural poor.* Taking forward a growing discourse among African intellectuals (Nabudere (1979); Shivji, 2002)) the work focuses on the 'un-heard' voices, and the context in which these voices and experiences are derived. The approach seeks to amplify the voice and analysis of the rural poor as reflected in both the Nelson Mandela Foundation's study on the experience of rural schooling, *Emerging Voices* (NMF, 2005) and in the report outlining the *Inkanyezi* experience (Leach, 2006). It emphasises the importance of listening to the lived experience and voices of educators, consciously acknowledging the current dominance of Western and urban oriented discourse at both a technological and policy level. Such an approach demands a nuanced approach to listening and observing, particularly as it relates to ICT.

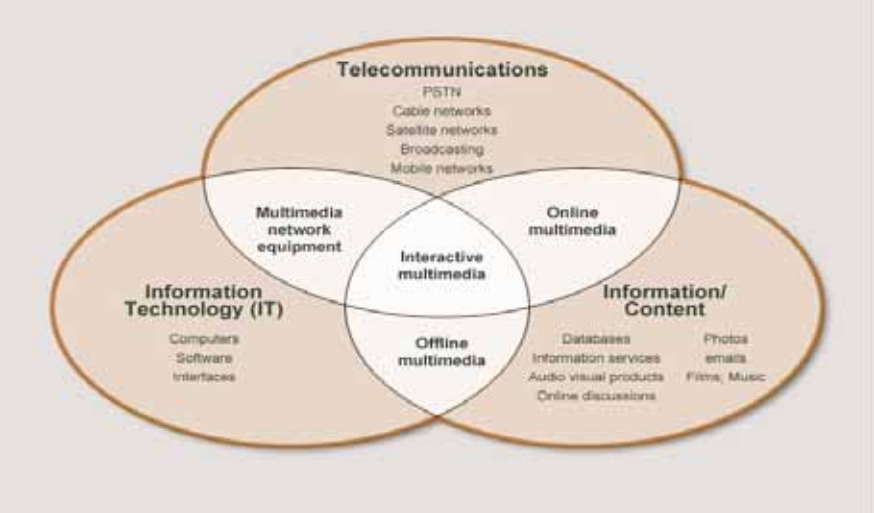
We also come to this debate with an open commitment to human rights and social justice. We ultimately judge the application of 'ICT' to 'schooling' on the basis of *social change*. Does the application of ICT in impoverished schools provide children and communities with a greater or lesser chance to engage in the world to create a more just world? Toward this end, we approach human agency – the capability of a human being, on an individual and collective level to engage in the world to effect positive change for herself and her family – as the ultimate driver of social change (Bruner, 1996, Freire, 1972). Agency is approximated with 'purposeful action', and therefore mediated by learning. The question of social change is then equated with how to stimulate agency, or purposeful action.

What is ICT?

The formal definition of 'Information and Communications Technology' embraced by the authors, emphasises the intersection of ICT content, and tele-communications enabling new forms of knowledge production and interactivity (see Figure 1, OECD). This definition embraces a broad conception of information and communication technologies. In its most important connotation it forces

us to look at the range of information and communication technologies used in rural communities historically to communicate and distribute information. In its more contemporary connotations, it embraces technologies such as radio and television, computers, newer digital devices (such as cell phones and handheld computers) and associated activities (the use and production of text, images, moving images, music making, photography etc.)

Figure 1: Information and Communication Technologies



While this provides a formal notional definition of 'information and communication technologies', it does not necessarily reflect the meaning of the word as it walks on the interface of rural schooling.

Indeed we want to make some provisional suggestions as a result of the research reported here. *First*, that the dominant 'discourse' or way of talking about 'ICT' is at least somewhat, if not largely, reflective of business interests. *Secondly*, that 'ICT's' have come to symbolically represent the bridge between impoverished and wealthy spaces. This dominant ICT discourse pervades the imagination of even extremely marginalised communities, who equate 'ama-computers' as the symbolic link bridging 'good' and 'bad' education, as well as the symbolic representation of 'possibility' for economic participation in an economy that feels otherwise shut down to meaningful participation. *Thirdly*, the 'ICT in education' discussion is quickly translated in practice into a discussion on 'computers/ computers labs in schools'.

Further research we argue is required in order for us to understand this trend whereby what is suggested to be 'right' or 'standard' (Cawthera, 2001) for impoverished schools (i.e. a replica urban office space furnished with rows of desk top computers) is unrelated to the contemporary technologies with meaning for local communities (for example, cell phones). This narrowing of the concept of ICT to a computer lab paradigm, which Unwin, (2005), dubs the 'computer tragedy' is pervasive in practice.

Arguments For ICT in rural settings

The most compelling argument for wading in the water of ICT in rural schooling is woven into our emerging understanding of the role of the information and communication technology revolution on a global scale over the past two decades. The magnitude of the impact of these technologies on contemporary living arguably implies a social revolution that is comparable to the social revolution that emerged from the technology of the fire, or the pen, albeit with different consequences. There are few who would not argue that access to the 'language' and practice of ICT becomes another battle line in the contestation for a more inclusive and democratically expressive society.

This argument suggests that access to the language and practice of information and communication technologies is so critical for contemporary inclusion that it should essentially be constituted as almost a human right, in essence encompassed within the right to a basic education (Leach and Moon, 2000). Most of the more specific arguments for pursuing ICT in education relate to this overarching argument. In the extended version of the paper we use social change theory to consider in some depth such arguments for the use of ICT, particularly as they relate to:

- *social structure* - without a massive commitment to ICT in public education, the current pattern of the so-called digital divide will remain unmediated, deepening social inequity and exclusion,
- *consciousness* - exposing both educators and learners to the tools of the day is an important contribution to developing a consciousness of an active thinker and participant with notions of local and global citizenry
- *relationships* - breaking isolation and expanding networks of communication and belonging
- *capabilities* - development of human capital

In relation to the latter, ICT is seen as particularly crucial in providing a learning tool for learners to directly widen their horizons of knowledge. It is also argued that access to ICT can increase the creative and critical capacities of learners as they come to understand ICT as a tool of expression (Leach, 2000).

It is important to note in this respect that there are some in the field of educational E-Learning who are motivated by the notion that ICT make possible the avoidance of teacher development by providing learners with a self-driven and self-paced tool for 'learning'. The authors of this paper suggest that these voices, while not dominant in education currently, are growing in their impact, and represent a challenge to the wider post-apartheid goal in South Africa of re-humanising and capacitating the system of public education.

Arguments Against ICT in rural settings

The most commonly presented argument 'against' ICTs in rural schools has its roots in an imagined 'traditionalist' position which argues that the exposure of young people to information and communication technology represents an intolerable onslaught to some form of local 'culture'. While there is little research to accurately describe the number and nature of people who subscribe to this position in South Africa, our experience is that a rigid perspective counter-posing ICT and local culture is relatively unusual or muted at the moment, and that people's concerns (if they have them) are more nuanced.

The argument articulated 'against' ICTs in rural schools does not disagree with the intentions of those who are more optimistic. It rather suggests that despite the promises, *under current conditions* South Africa not only runs the risk of exacerbating historic inequities, but is likely to contribute to a cycle of development whereby the poor, (and in this case particularly educators in impoverished schools) are ultimately blamed for their continued 'failure' to live up to the imagined promise.

Four central issues generated by our research are a particular cause for concern in this respect: cost structure, social conditions, setting up the fall, dominant knowledge systems.

1. Its Expensive

Educational budgets in South Africa are under extreme pressures to provide the most basic educational resources such as water, electricity, pencils and paper. Currently, the Eastern Cape has reached the minimal target of providing R100 per learner at the school level, representing all non-personnel costs facing public schooling. What this means on a day to day for rural learners is few to no books, no interesting or creative materials for educational play, no heating on winter days, and certainly no access to interesting resources. The huge increase in expenditure to make possible 'ICT roll outs' in terms of computer lab provision is contingent on private sector contributions. Even so, the considerable short, medium and long term recurrent costs relegated to the state have not yet been fully studied or understood, nor systematically incorporated into medium term expenditure frameworks.

More studies on costs in the context of rural schooling are required. Kidi, Mbowa and Owino of the Kenya Teachers e-Forum suggest that it costs almost as much to maintain a desktop computer annually in the rural context as to buy it.

An additional concern is that current models of ICT in rural schools assume that schools will bear responsibility for recurrent costs, including maintenance and materials. There are few studies about the scale of recurrent costs over time, specifically in rural contexts. Power (2006) has used a total cost of ownership model to argue that when maintenance, electricity, paper and ink are taken into account, the on- costs of 16 absolutely 'free' (donated) refurbished computers are probably beyond the means of most poor communities. Many schools have been led to increasing school fees (and thereby eliminating through social pressure the children of the poorest of the poor) or accepting their 'failure' to maintain the investment. Thus, in a very real way, the investment of ICT's in rural schooling increases the costs borne by communities for education.

This suggests that unless current financing models for ICT investments in schools – as well as the nature and forms of ICT themselves - are challenged, current practice will deepen social exclusion of learners from impoverished families.

2. Social Conditions

Much of the empirical evidence of 'promise' has been largely gained in well-resourced urban schools (InfoDev, 2005). The larger scale policy implementation visions and models are using such sources of 'promise' and extending these to impoverished contexts, with little focused attention on creating the enabling conditions for success. There has been insufficient research we argue to accurately present a model of how such conditions interact to create the conditions for promise.

3. Setting Up the Fall

The implications are deeper than simply suggesting, 'it will be difficult.' This argument suggests that without due care *we may implicitly be setting-up rural and impoverished schools for a failure*.

The intention of large-scale rural public schooling under apartheid was not to create a system that truly empowered rural learners to navigate their best lives. The system was itself scaffolding for low quality educational outputs. At the level of public awareness, the 'failure' of rural schooling is becoming increasingly disassociated with its historic roots and is increasingly associated with the 'failure' of education departments on the one hand and the 'useless' rural teachers and principals on the other. Indeed rural educators themselves absorb the patterns of failure into a self-consciousness of defeat. Rural educators are largely demoralised and have far too few experiences of 'victory' (NMF, 2005).

The public (urban and rural) buys into a discourse that places a direct link between ICT and educational quality. There is a popular understanding that 'computers' are a decisive determiner of educational quality, rather than a result of certain enabling conditions that are more conducive to sustainable educational quality.

Our research shows that rural schools are largely unable to mediate such promise. Desktop computers break and sit unfixed, since there is no technical support and no means to transport

the computer to get serviced. Teachers are not trained. They get alienated or fearful. The community becomes increasingly frustrated with the educators who seem unable, despite all the odds on their side, to mediate good education for their children. Educators, experiencing failure once again, withdraw into the different forms of dependency and withdrawal that emerge from public failure.

4. Re-Colonising Potentials

The final argument is perhaps the most important, if not the most difficult to put to words. It lies on the interface of our minds, our own sense of power to create in the world, and where we accept that the power for creation lies. It suggests that the impact of ICT on education in rural schooling is dependent upon the power we place (through language, imagery or practice) on the technology in relationship to 'quality education'. If we approach the technology in a way that implies that the technology is a determining factor in producing educational quality, we locate quality further away from the locus of control of local capacity. This holds the danger of further eroding the agency of rural educators.

This story is not inevitable. But we suggest it will be if the public and the educational community buys into the current dominant paradigm of ICT. Such a scenario is mediated only if both the public and private sector drivers understand, articulate and act to mediate the *enabling conditions* that support the 'promise' in the context of rural and impoverished schools.

In the final section of this paper we suggest what some of these *enabling conditions* might be.

First we set out the research findings that have contributed to this analysis.

The Eastern Cape context

The research reported here was carried out in the Eastern Cape. Data shows that the provincial share of the poverty gap within South Africa [1]nationally is greatest by far in Eastern Cape[2]. South Africa's GDP per head is $2,500 but within the Eastern Cape falls to $432. Even that figure is a glib average that masks the intense deprivation of many of the remote corners of the province by comparison with the bustling and relatively thriving areas around East London, King Williamstown and Grahamstown.

In terms of access to and use of new forms of ICT the picture remains comparable. Across South Africa as a whole there are 72.6 computers and 410.5 fixed line and mobile telephones for every 1000 of the population and 3.1 million Internet users. However, most of these resources are concentrated in urban areas. Some rich suburbs for instance, have 70 phones per 100 people. In the remoter parts of the Eastern Cape this statistic falls as low as 0.1 per 1000 people – the same is true for access to PCs (Accenture, 2001).

[1] i.e. the combined measure of numbers in poverty and their depth below the poverty line

[2] The comparative provincial data is: Gauteng 4%, Northern Province 16.5% Kwa Zula Natal 19.9%; Western Cape 3.4% Northern Cape 1.9% Free State 9.9%, Eastern Cape 24.9%.

Figure 2: Households with computers, South Africa

Province	Percentage of households with computers
Eastern Cape	4
Free State	4.9
Gauteng	15.1
KwaZulu Natal	7.1
Limpopo	2.2
Mpumalanga	4.7
Northern cape	7.1
North west	3.9
Western cape	18.2
South Africa	8.6

Source: Statistics SA (2003:97)

A small survey carried out as early as 2002 with teachers in the *Inkanyezi* project on their use of ICT showed that none owned a computer and 14 (58%) had never seen or used a computer. The majority 18 (75%) had never used the Internet. Of those 10 teachers who had prior experience of computers, only 5 had '*occasionally*' used them in relation to teaching; 4 of the 5 worked in town schools. The other 5 had '*occasionally*' used a computer at an Internet or study centre, or with a friend, but never for teaching. Previous applications of the technology were overwhelmingly for 'personal use'.

Figure 3: Teachers' Prior use of technology: Eastern Cape January 2002 No=24

TECHNOLOGY	No. used before (%)	No. never used before (5)
Computer	10 (43.5)	14 (58.3)
Mobile Phone	15 (71.4)	6 (28.6)
Television	21 (87.5)	3 (12.5)
Radio	19 (82.6)	4 (17.4)
Internet	6 (27.3)	18 (75.0)

Schools in the *Inkanyezi* study varied significantly in the range of technologies, and other resources they had access to, but the majority had no electricity or telephone connectivity and only three had a computer.

Recent statistics and current experience suggests that in one respect this picture is already much changed. Across Africa generally, the technological context in relation to use of mobile technologies is developing fast, even in rural settings. South Africa is no exception.

Such change is illustrated by feedback from teachers in the 'ICT' schools who completed questionnaires in the October 2005 evaluation. The majority has '*some*' or *'a lot'* of experience of TV (35:97%), Radio (32.91%) and Cell Phone use (33.94%). Their general ICT-use profile is somewhat different to that displayed in Figure 1 some four years or so earlier, amongst a similar demographic.

Figure 4: Teachers' Use of Technology: Eastern Cape November 2005 No=35

TECHNOLOGY	No. used before (%)	No. never used before (5)
Computer	29 (82%)	6 (17%)
Mobile Phone	33 (94%)	2 (6%)
Television	34 (97%)	1 (3%)
Radio	32 (91%)	3 (9%)
Internet	17 (49%)	18 (51%)

That the majority of these teachers (29: 82%) reported experience of desk top computers is unremarkable, since this recent study was specifically carried with teachers working at rural schools provided with computer suites. Nevertheless, more than half of these teachers also reported that they had access to a computer outside of school (20: 57%) and 8 (22%) own their own computer. Use outside of school includes "access to a friend's computer" (14%: 5), through Unitra Community Radio Service (1), at Internet Cafes (4) and for study at Walter Sisulu University (1) and ITEC (1). It is interesting to note that most of those using their own computers and/or with experience of lap top use are in the 20-29 age group.

Teachers' cell phone use (33:94%) mirrors what is known about the adoption rate generally of mobile technologies in Africa generally. It is now amongst the highest rates globally and forecasts estimate almost 100 million mobile users in Africa by 2005 (Shapshak, 2002). It is clear that the adoption rate of mobile technologies is exceptional in Africa. The continent is leapfrogging from an unwired, nonexistent technology-enhanced infrastructure to a wireless infrastructure.

Similar developments are taking place in many developing regions other than Africa, such as in rural areas of China and countries in South America.

The Inkanyezi Research Project (2001-4)
This research project has been documented in detail elsewhere. (Leach, 2006). . The research focused on the impact of ICT on pedagogic practice and pupil motivation and achievement. Pairs of teachers from twelve schools used a mobile toolkit (including a shared lap top and personal hand held computers) to carry out and evaluate a series of professional activities leading to enhanced classroom practices in numeracy, literacy and science

Findings showed that:

- Mobile technologies enhanced teachers professionl knowledge and capabilities by extending subject knowledge, enabling planning and preparation for teaching to be more effective, developing the range of teachers existing pedagogic practices;
- Every teacher introduced the mobile devices into planned leassons and there was wide ranging evidence of positive outcomes for learning
- Students used the devices to carry out a range of literacy, numeracy and scientific activities. They showed high levels of motivation and a range of achievements, including improvements in reading, were reported by teachers, parents, school principals and students themselves.

Teachers, together with parents, governors, school principals and community members reporrted that use of new technologies had positive effects on learner motivation and the quality of learning. The professional status and self esteem of teachers was also enhanced within their immediate communities and more broadly in the societies they serve.

'Computer Lab' evaluation (2005)
This evaluation encompassed 9 (38%) of 24 identified 'ICT' schools (14 secondary and 21 primary) – around the Umtata district. All schools had received computer lab donations between 2003 and 4, together with five days basic skills training for all staff members and some parents and governors.

URSD and DEEP researchers worked jointly on the research design and scoping of partners' respective roles between August and December 2005, using face-to-face, e-mail and video conferencing means. An earlier evaluation of this ICT innovation had focused in detail on technical issues, therefore it was agreed that this study should focus primarily on participants' experiences and views of using ICT, as well as documenting the kind of practices (if any) the intervention generated. Appendix 2 sets out Technical Issues.

Researchers worked in two small teams using a common framework over a period of one week, October 16th- 25th 2005. Each team included a member of the URSD staff and a member of OU staff. Each team also included an ICT specialist. The research team's main focus during scheduled half-day school visits was

- discussions with school principals, SGB (where they had been invited by the school principal) and selected teachers;
- completion of brief questionnaires;

- observations of learners using desktop computers;
- assessment of technical issues.

45 teachers were interviewed and 35 of those also completed questionnaires.

Teacher profiles

Of the 45 teachers interviewed, 10 specialised in science and 10 in literacy. Other subjects represented: numeracy (8), accounting (2), history (3), music (1), life orientation (1), geography (1), woodwork (1), agricultural science (1). 4 teachers specialised in computer literacy; 23 of those interviewed are now responsible for teaching this as a subject to learners.

25 (71%) of those completing questionnaires were male. The majority were in the 30-39 age group (18: 51%) and had over 3 years teaching experience (28: 80%)

The majority of those completing questionnaires judged they had 'a lot' of experience of cell phones, TV and radio. 74% (26) also judged themselves now to have 'a lot' (11) or 'some' (15) experience of desktop computers. Of those interviewed who had received some form of computer training 91% rated their confidence to use computers as a result of the training as 'high' or 'some' impact. However, only 37% (13) said they continued to use a computer for school related work.

Most teachers reported they felt confident about their ability to use computers in teaching as a result of the IT training. 69 % (16) said the training had "high" (10) or "some" (6) impact on their ability to use computers with learners. However, only those responsible for teaching computer literacy were able to answer questions about their actual use of computers for teaching and learning. The kind of activities teachers used most with learners were: word processing and spreadsheet exercises.

Teachers identified the main barriers to developing their use of the computers as

- Lack of time to use the computers (36%:9)
- Lack of machines (24%:6)
- Technical problems (24%: 6)

Other barriers discussed included:

- Lack of money for electricity and ink;
- No on-site technical support;
- Need for more training.

Location and timetabling of computer lab use

The location of computers within computer labs on the school campus was cited by many teachers as a barrier to use. Most teachers, except those designated to teach computer literacy, were situated physically some distance from the computer lab and not timetabled to use it during school hours. These teachers had to make a concerted effort to find time to visit the computer lab in a day already overcrowded with teaching commitments and large classes.

In addition, as documented in '*Emerging Voices*' many educators commute to the rural schools, some have long journeys. This made it is extremely difficult for them to spend time working on the computers out of school hours, as they had to be ready for taxi or lift at the end of the school day.

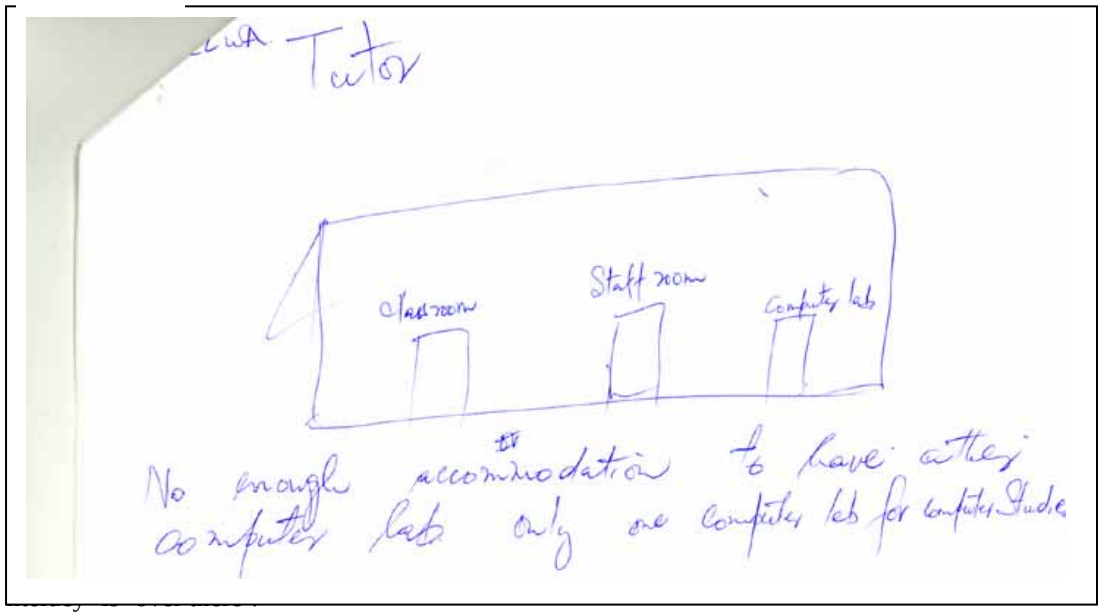
In almost every school visited, small group of teachers (max. 3 or 4) had established a close working relationship with the computer studies teacher or the school's ICT 'champion'. This group tended to go to the computer lab at any break in the school day and sometime after school, playing games on the computer, or preparing schedules or worksheets together. Such groups in effect established "ownership" of the computer lab, and were observed to be at home with ICT use and engaged in professional activities, including carrying out whole school and management tasks (e.g. timetabling, school principals' letters).

Teacher views on the computers in the schools

All schools visited use a similar model of computer provision and learning space i.e. between 12 and 20 computers situated in a single room. The positioning of these rooms on each school campus varies. In Z_____ and C_____, for instance the computer room is situated in a block some distance from most teaching classrooms. B_____ is a small farm school with only 3 classrooms end on to the school

principal's office, which is now used as the computer room. Here, by contrast, there is close proximity between the computer and teaching rooms.

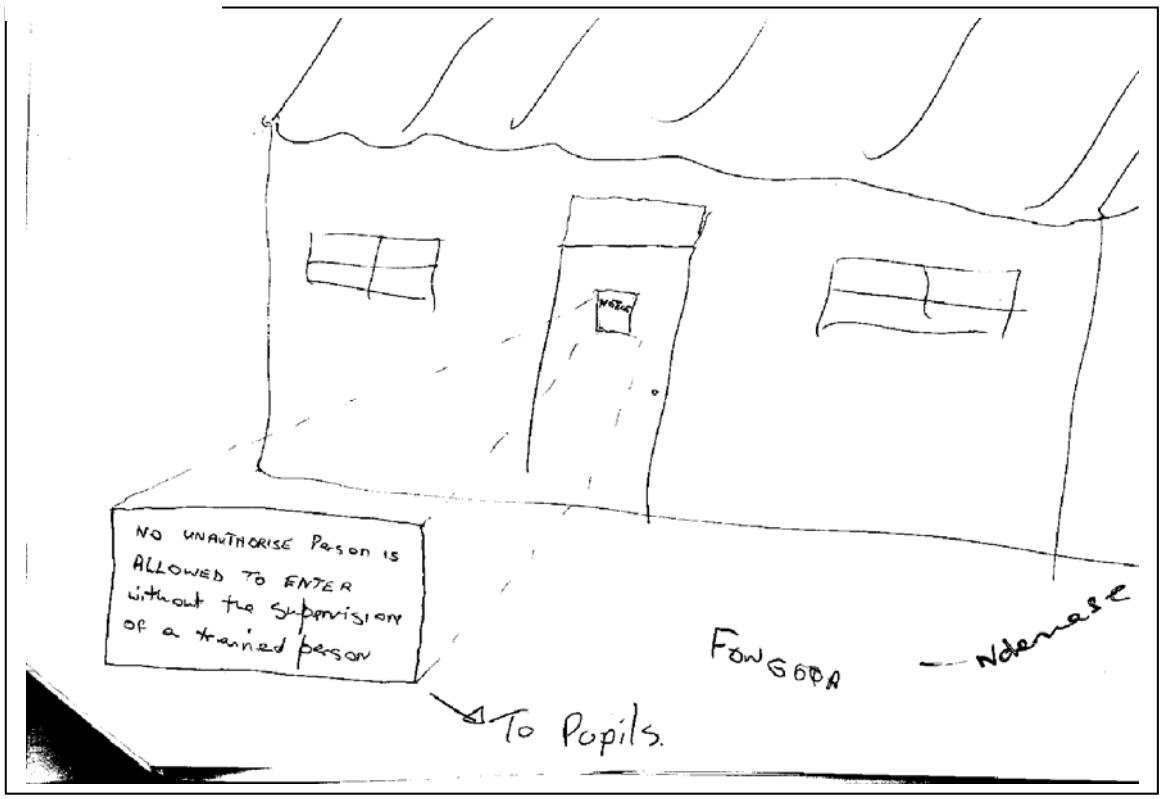
Figure 5



Computers and security

School principals and some teachers knew and worried about the monetary value of their ICT resources. The range of technological means to prevent theft was highly visible in the computer lab installations (burglar bars/ sensors etc) and highlighted such concerns. This was responded to in a variety of ways by schools. In some, posters encouraged children to care for the equipment. At the other extreme the computer lab has become a 'hallowed place' where learners - and even teachers in some circumstances – could not enter without close supervision. In most schools the arrival of alarms, burglar bars and even new fences around the school gave a sense of separation from the community (Figure 6).

Figure 6



Classroom organisation

In every school the computers are housed in computer labs with desktop computers ranged along classroom walls. In most schools the predominant impact of the computer room is much like an office, with children instead of office workers, silently sitting in groups intent on screens in front of them.

Figure 7 is illustrative of the large numbers of learners sharing one computer in the computer labs visited. 'Too few computers', 'one computer, many learners' was one of the most frequently heard barriers to using ICT effectively. Teachers generally seemed to combine the individual orientated methods of 'tell' and 'do' regardless of the numbers sharing a computer. Pupils were obliged to take turns, in groups of between 4 and 8, to practice an ICT skill, or passively watch whilst a dominant pupil undertook the task.

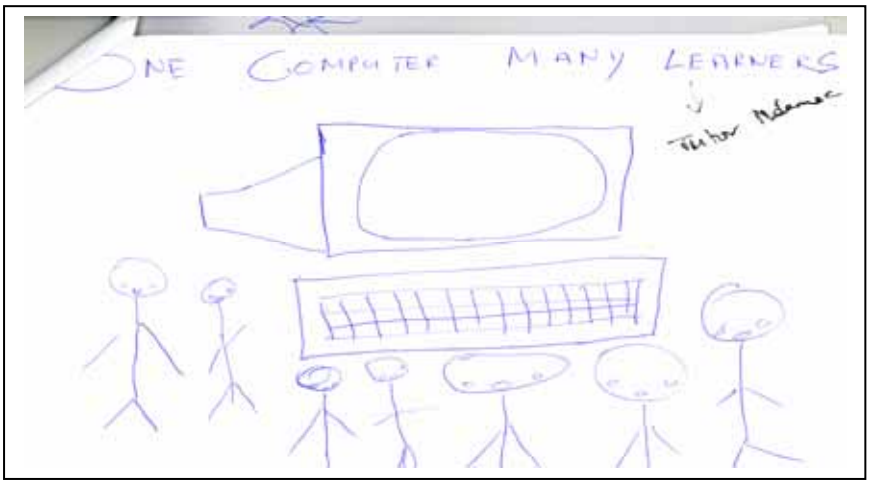


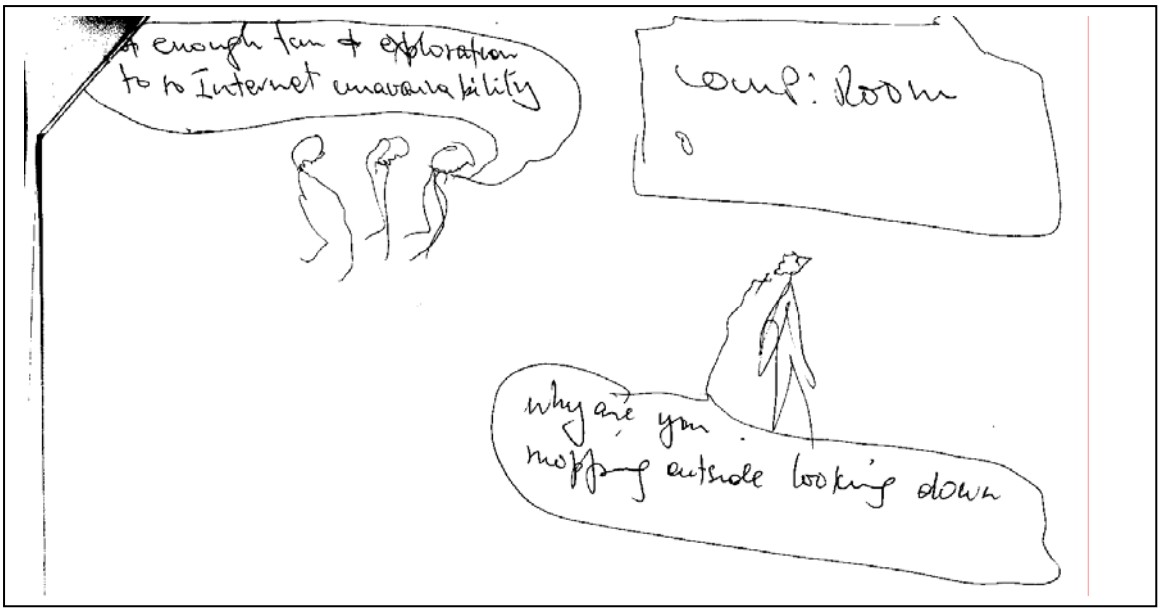
Figure 7 *Using computers within the school curriculum*

Many teachers became animated when invited to talk about the kind of activities pupils currently enjoy most in school. A primary teacher with a specialism in maths described using chalk to map out a hop scotch games for teaching number to very young children. Music is loved and much enjoyed in all the schools.

A recurring theme in school visits was teachers' strong desire to use ICT within their everyday teaching and learning, particularly to support what they perceived to be problem areas both in teaching and learning and also to improve 'active' learning. There was a general view amongst teachers that ICT might help with many of the more abstract and difficult areas of the curriculum. Maths teachers for instance, consistently reported they had difficulty in teaching aspects of their subject, which are also essential requirements of the curriculum – geometry was an example frequently given. Music teachers said they would like to widen childrens' knowledge of musical instruments and a range of musical genres (also a requirement of the curriculum). Similar themes recurred in history. Science teachers were especially articulate about the limitation of their work without subject specific resources. Teachers were generally frustrated by the sense that ICT could be a powerful tool in their subject, that it would enhance learning, but they did not know how.

The majority of teachers emphasised that the only software applications they had access to and knew how to use were Word and Excel. They seemed broadly aware that subject specific software existed. They also talked about the potential they believed the Internet would have for learners accessing a wide range of subject information and resources (Figure 8). This potential was based on personal experiences with Internet use for their own study. Despite these desires for curriculum use, it was noted that pupils used Word or Excel to carry out decontextualised, random tasks unrelated to curriculum activity or subject learning. One group, for example, were physically creating spreadsheets, and populating them with arbitrary categories- apple/orange/banana with no sense of purpose or meaning.

Figure 8



Linked to these discussions, some teachers articulated their own limitations in certain aspects of subject knowledge for teaching. An immense enthusiasm was evident in most schools not just for access to classroom resources through ICT, but also to deepen their own knowledge of how to teach their subject. The lack of opportunity for professional development and the isolation of rural schools from new ideas about teaching and learning was a constant thread in discussion – and an additional source of frustration.

Although cynicism and inertia was evident amongst some teachers, the most lasting impression was of committed adults working day after day in resource- less circumstances, dedicated to their pupils and longing for professional challenges. The sense of frustration that computers held unlocked promise was palpable. Yet the only ICT activities we observed pupils doing were humdrum, meaningless IT skills practice.

Teaching methods in the study schools

Class sizes are very large in many of the schools in the sample; there can be as many as 80 learners in one small, stuffy classroom. Children sit on the desks and share chairs. In some classrooms there are no tables; some of the computer labs still need chairs. The daily struggle to teach under these circumstances with few other resources than chalk means that teaching methods other than rote learning, copying and didactic 'chalk and talk' are exceptional. It is important to stress the commitment that many teachers continue to have to the task of teaching in such impossible professional circumstances, rather than focusing on the limitations of teachers' approaches.

Teachers we spoke to intuit that ICT might provide a range of the resources, practical approaches and subject aids that they long for to make their teaching more effective. Fig. encapsulates this *desire 'Teacher only telling and learners just listening; without ICT and resources teacher is confined to these methods'*.

Summary findings

Findings
Computers are mostly physically separate from main school activity IT activity is seen as separate from the main business of teaching and learning
Occasional computer use means that teachers' confidence does not develop, especially for using ICT with learners
Where teachers do use ICT with learners, activities mirror the highly decontextualised basic skills activities they received in their own training
Teachers had large classes and few other reources; they saw pupils sharing computers as an additional problem they had to face
Teachers are keen to use computers in the curriculum however training did not prepare them for such activity
Teachers are keen to access subject software
Teachers are keen to develop their own professional knowledge of the subjects they teach
Teachers are keen for learners to access the Internet as part of the curriculum
The advent of computers had in many cases deepened the gap between school and community and fuelled a sense of inadequacy

Researching the enabling conditions for technology enhanced practices in rural schools and their communities

As part of our research we interviewed 23 'expert witnesses', mainly from South Africa, but also key opinion formers and thoughtful people further afield. They included learners, educators, activists, researchers, policy makers, ICT specialists, and donors (see http:www.open.ac.uk.deep/podcasts), including participants from the Inkanyezi project who are still actively engaged in ICT within their schools. We also surveyed the literature focusing on ICT and education, particularly in the South. We are seeking to use this evidence to identify the enabling conditions and alternative paradigms that might help grow real technology enhanced, quality learning in rural schools and their communities.

In order to convey some of these ideas we have used the metaphor of the baobab tree. Why the baobab? There are two reasons.

First the baobab is a tree native to Africa; it has always played a special role in local environments and is uniquely adapted to thesettings in which is grows. It can grow up to 25 metres and live for several 1000 years. This serves as a metaphor that underlines one of our key starting points - the importance of taking a long and historical view in any new development. It also emphasises that for real growth and for authentic processes to take deep root, they must be adapted thoughtfully to and by the local setting.

Second the baobab tree has many uses for the local communities – the bark can be used to make rope, mats, blankets, paper and cloth. Glue can be made from the pollen. The fruit contains vitamin C. This serves to reminds us that ICT is not one thing (such as a computer lab). It takes on many quite different

forms and purposes that can be as relevant to agriculturalists, health workers, educators and scientists as to the world of business.

The baobab metaphor also allows us to think visually about the main foundations – roots – of real technology enhanced growth. The beauty of this model is that suggestions for strngthening roots and branches can be amended or replaced as new, or better research comes available.

We have identified *curriculum and pedagogic training* as the mainstay of growth – the runk of the tree (Appendix 1). In addition we propose, distilled from the research findings, eight anchoring roots, sustained in the rich soil of practice and pedagogy:

- *personal access;*
- *appropriate technologies;*
- *real purposes;*
- *professional networks and role models;*
- *extended practice;*
- *critical understanding of the role of technologies in learning;*
- *technical support;*
- *public affirmation and feedback*

In the final part of the paper we use a short case study distilled from the research on Inkanyezi to illustrate these eight key roots or *enabling conditions* for technology enhanced learning in practice in a challenged rural settings.

The case study challenges the dominant 'computer lab' model and proposes research into new paradigms that incorporate mobile technologies and which take account of the kinds of ICT activities rural teachers already know and use.

Case Study

We have been following the development of Intabambanane School (the school and teachers names have been changed) since 2002 and earlier research (Leach, 2006) details that school's work in the *Inkanyezi* programme. Intambanane is situated in one of the poorest areas of the Eastern Cape where unemployment and subsistence living are the norm. The school is situated in a small village one hours' drive on unmade road from the small town of Berlin and has almost 200 learners. When we first visited, it was seen as a 'failing' school. Learners were out of control and disaffected. 'Teachers backs were against the wall', said the District Education Officer, parents never came near the school, staff morale was low.

Personal access and appropriate technologies

Of the two teachers that applied to be in the Inkanyezi project, Zama had some ICT experience through personal study at East London's Internet café, Ncedo had none. They were supported in the project by the school principal and given time to work on the programme. Both teachers were provided with personal daily use of a powerful hand held computer incorporating a digital camera. They also shared one laptop and all-in-one printer/ scanner/photocopier. These technologies had been chosen as most appropriate for developing personal ICT capability and confidence, whilst also enabling teachers to investigate new practices with their learners.

Five years on, the teachers are still using the hand helds on a daily basis for personal and professional use. The original printer is still in use, as are the digital cameras. The original laptop was stolen earlier this year from a technician's workshop in East London, where it was being repaired after four years' hard use. The teachers have replaced this with ' a much more up to date model, locally manufactured', paid for out of their own salary but still used in the school, because it is so important to the life of the school.

The orginal case study (Leach, 2006 page 91-93) indicated that the school had been overjoyed by succeeding in a bid to get 16 refurbished PCs from a donor in Cape Town (2004). These machines are still stored in homes in the village, unused – 'we cant afford the electricity to run them or build a secure room to house them' Zama told us, 'in any case a lot of the plugs were not local and wires were missing'.

Real purposes and professional networks

The *Inkanyezi* programme focussed on curriculum and pedagogic issues. Zama and Ncedo got the opportunity to evaluate a range of classroom based ICT literacy, numeracy, communication and science activities from the outset. These activities were designed to complement and enhance their teaching. The work demanded courage, persistence and the ability to take risks. Peer support from the school principal and the sharing of practice with others in the programme was - and still is - hugely important to Zama and Ncedo. Such networks, facilitated by SMS, created public conversations that built small communities of practice critical for teacher learning (Shulman and Shulman, 2004)

'Extended' classroom use

Working with one class of grade 6 learners and the single laptop, using a group based approach devised by the cluster group, the teachers tried out a series of individual and collaborative activities over a term's period. Peers taught each other basic skills and then the computer was integrated into key literacy and science activities. Research showed that these activities improved motivation, enhanced their social, literacy and scientific knowledge. Learjners also developed 21st centruy skills such as using the Internet for research, to create authentic products and to be confident in making public multi media presentations. Each of these activites built on established research on the way in which ICT can enhance pedagogy.

Some five years on, the most successful ICT enhanced activities are now fully integrated into the school's regular curriculum. All children leave the school knowing how to use the laptop individually and in groups, to develop their learning. When we interviewed a group of school leavers, we found that they had already written on the chalkboard twelve questions they thought we might ask. We used these to investigate their experiences and to establish that they still had a clear knowledge of the advantages of ICT use in their own learning and personal development.

Technical support

No technical support is available at or near the school. The teachers have, over time, relied on e-mail and SMS for help- or whan essential have taken the mobile devices to the nearest town for repair. It has been clear that technical support is vital; if not available it can disable a key learning resource for significant periods of time.

In a recent development, the school is leading a pilot study using a mobile classroom- a robust motorbike and sidecar equipped with 5 lap tops, 2 digital cameras and cinema for use by teachers and their classes for several days at a time. The bike is driven by an experience technician and IT trainer who will stay in the village for several days, supporting the school and community with technical issues, carry out training for school and community and help with Internet connectivity and so forth.

Public affirmation and feedback

The Inkanyezi programme unexpectedly discovered that the public sharing of new learning with the local community, parents, educational officials and other key members of the community was critical. It increased teacher confidence and sense of agency and esteem. It encouraged parents and district officials to care about the school and become involved in its life. This is key enabling condition and one that is largely overlooked in new technology practices

Critcal understanding of the role of technologies in human learning

Inkanyezi encourages teachers to investigate and critically appraise ICT practices. Intambane School has, over time, now developed an idiosynctratic and integrated approach to ICT for learning in the school. Zama has now become school principal and ensures that as many learners and staff as possible use new technologies. He has developed a mission statement proudly displayed in his study/ cum Grade 5 classroom, about the importance of ICT for 'a keen interest in learning'.

In addition he is leading on the trialling of a new system for the District in which he can, with ease, log and then e-mail the school enrollment and attendance figures to ensure he gets the badly needed finances on which his small school depends.

Conclusion

In this brief paper we have set out our objective to research the application of ICT to rural schooling. There is a dearth of research on the impact of ICT on educational achievement in rural contexts. The argument of caution with reference to the interplay between ICT and rural schooling, suggest that despite the promises, under dominant paradigms and consciousnesses, engagement between ICT and rural schools is not only likely to exacerbate historic inequities, but is also likely to contribute to a development cycle whereby the poor are blamed for their 'failure to rise', further frustrating lives, and alienating the rural poor from middle class sensibilities.

There is still scant empirical evidence to suggest whether the 'promises' can hold in less resourced contexts. We have highlighted the importance of investigating the enabling conditions in which ICT might contribute to educational reform, as well as mobilise and give voice to teachers who hitherto have been marginalised or silenced. This important agenda raises new avenues and critical and urgent questions for research:

- Is there a role for new mobile technologies in rebuilding the professional world of the teacher in the rural hinterlands?
- How can mobile technologies help address specific problems faced by rural educators ?
- What policies and innovations are needed to support the enabling conditions for technology enhanced learning?

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Appendix 2 Summary of technical issues

Most of the computer suites are organised around a common hardware and software specification. Schools varied as to the number of computers and printers that were operating when we visited. None of the schools were yet able to access the Internet and none of the schools had any on-site technical support, although in some cases one or more of the teaching staff had developed some significant expertise.

Some colour printers were no longer in use because of the cost of ink cartridges. Costs of maintenance were consistently raised as both a barrier to use and and a concern to school principals in their budgeting.

It is important to note that (with the exception of the school who did not attend for interview), despite costs and substantive technical issues, all the schools were ongoingly using the computer labs for computer literacy activities. School principals, SGB and teachers emphasised the importance of the computers to the status and effectiveness of the school and its position in the local community.

Connectivity

As the workstations in all the schools visited are networked, there is site connectivity to the server and the printers. The server itself is internet-ready via fax modems for landlines. In the main, this was the only part of the implementation of the Phase 1 ICT Agenda Agenda yet to be achieved at the time of the visits. Most schools have no or limited connection to the Telkom network, which in itself can be very slow even for a single access point. Classroom access via standard dialup would be largely inefficient.

Consumables

The setup of a black and & whitelaser as the main printing device, then more infrequent use of a second, colour printer is a good one, in terms of costs. Toner is cheaper than ink in terms of sustainability, and the separate colour cartridges are also better than single 3-colour units.
Some schools use of colour printing is higher than expected and some have run out of ink that has not been replaced.
In the secondary schools there is habitual use of the laser machines to duplicate exam papers formerly done at a printers or by Gestetner machines.

Electricity

The largest ongoing costs to the schools are those for electricity supply. The actual costs in all schools visited were difficult to estimate, and the perception as to the impact varied. With most or all equipment on with the school engaged in ‘normal’ activity, electricity consumption varied from about 0.6kwh to 1.2kwh. The highest example apparently equated to a R250 voucher being used up in about 30 days.
The most varied response in relation to technical issues received from the school staff was on the ongoing costs of electricity – even those aware of the bills considered the electricity either to be expensive, or not a significant increase – a continuum of perception.
No school was failing to use the computers because of electrical costs but it was raised as an issue of concern for the future.

Technical support

Significant but ‘unseen’ costs are related to ongoing support currently provided by the URSD team. In many cases the research team found equipment that was not working (e.g. crashed PCs or jammed printers). This simply had to be left inoperable until the next site visit.
In one case, use of all equipment simultaneously would overload the 20A fused circuit and therefore only 7 machines could be used. This is a problem would require further investigation by an electrician to resolve.

Schools’ understandings of IT infrastructure issues

In one school the server is turned off unless printing is required in order to save costs. Due to the configuration, this had a knock on effect on the UPS, rendering it obsolete – until staff were informed which part of the unit would be best to switch off (leaving the UPS charging).
In a couple of cases the operation of the security system was not well understood – and was inactive. One school was seen by the community as a secure environment so PCs previously in homes had been moved into the IT labs (and are possibly being used much less as a result).
Additional security arrangements e.g. a cage under the roof had been added in one location.

Technical management of ICT in the schools

The UPS potentially provides a good backup system at times of power loss. Recharging takes 8hours for a 33min period of extended power for 2 workstations.
A server-driven network has the benefit of centralising resources and workspaces, in addition to providing print (and potentially internet) access. This facility is, however, little understood and therefore little used in the schools visited.
Learners report that they tend to use the same machines in order to continue work from a previous session, or else they start from scratch if on a different machine.
The lack of resources – reference material or captured websites – also accounts for lack of use, since the educators can see no apparent advantage of working with shared areas.

Software issues

All schools are encouraged to take advantage of the Microsoft software entitlement, which consists of 25 CDs of software – applications plus additional material. The software includes advanced programming packages in addition to the standard Office suite, but there is no additional documentation or ‘how-to’ guides.
Specific educational resources are not included per-se – nor is Microsoft Encarta for example – and whether educational software is loaded onto individual machine is currently for individual schools to decide.