A tale of two ICTEd4D projects

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In this chapter we describe and discuss two ICT in Education for development (ICTEd4D) projects, based in schools in rural and peri-urban communities in South Africa. The two projects share a number of features, including their general orientation, the targeting of marginalised sections of South African society and even some of the participants. The differences between the two, however, offer the space for some reflection pertaining to ICT for development (ICT4D) in an educational setting in general. In this brief account we focus on the differences in funding, buy-in and the impact of the two projects. This moment of reflection comes at a time when both projects are entering a more unified and coordinated structure, that of the Living Labs network in Southern Africa.

Keywords ICT for development, ICT in Education in Africa, Living Labs, open-source

1. Introduction

In this chapter we discuss two interventions which, in our opinions, constitute examples of good practice in ICT in Education for development (ICTEd4D). A key success factor in both projects has been a holistic and multidisciplinary approach, implemented through the model of the “Living Lab”. Both projects are based in schools within marginalised communities in the Eastern Cape Province of South Africa. The goal of both projects is to have a positive impact on the life of whole communities through ICT. Schools were chosen as points of presence because they are established centres for access to knowledge and for community life. In some cases, they are also the only buildings in the community to have a reliable electricity supply. The first project, called e-Yethu, is situated in a township while the second, called Siyakhula, is situated in a rural community. After discussing the relevant context and providing a brief description of the projects, we reflect on the two experiences and draw some conclusions on the lessons learnt.

2. Digital divide in South African education

The digital divide which separates the “ICT-haves” from the “ICT-have-nots” cuts across all aspects of daily life, including education. Access to the use of ICT in education promises to improve the life of members of marginalised communities and to contribute in filling the gap [1]. Far from being a panacea for all educational, social and economic problems, ICT needs to be implemented carefully and to respond to the needs of target users. This is particularly true in the case of ICT in Education in developing contexts, where reliance on models developed in the West seems to perpetuate rather than address past inequalities [2]. In order to be successful, the implementation of ICT in Education in a developmental context needs to shape and follow innovative models.

Africa lags behind in terms of ICT infrastructure and Internet penetration. On the continent, there are significant differences between as well as within countries. Because of its peculiar history and current socio-economic diversity, South Africa offers examples of a vast array of realities, ranging from modern metropolitan suburbs to remote rural areas. Boosted by one of the strongest economies on the continent, the South African Government set rather ambitious goals in terms of ICT implementation in Education. All schools are expected to be connected, and all learners and educators are expected to be computer literate by 2013 [3]. Recent research investigating Internet penetration in South Africa found that at the end of 2009 the number of South African Internet users passed 5-million accounting for a penetration of 10% for the country as a whole [4]. In the e-Education whitepaper released in 2004, it is stated that the Eastern Cape, where this research takes place, has 6300 school of which only 8.8% have ICT facilities and only 4.5% use these for teaching and learning [3]. Most schools with ICT access are situated in comparatively well-off urban areas and cater for a relatively privileged minority.

The majority of the South African population lives in peri-urban areas called townships or in rural areas [5]. Most rural and township schools are characterised by a lack of infrastructure, resources and capacity to support ICT in Education. Programmes and interventions to address these problems have been rather haphazard and have moved at a slow pace. Most projects we have come across share well-understood challenges within the field: security of the ICT equipment, lack of skills among educators, issues of management and motivation of key stakeholders [6, 7, 8]. The two projects discussed here follow a holistic, multidisciplinary and collaborative approach which, we believe, has been a key success factor.
3. The e-Yethu project

3.1 Project history and background

The e-Yethu project started in 2004 as an attempt to co-ordinate ICTEd4D activities by staff and students in the Education and Computer Science departments at Rhodes University. Rhodes is a historically “white” institution characterised by good resources and infrastructure as well as a tradition of excellence. It is based in Grahamstown, a comparatively small town (approximately 120000 inhabitants) in the Eastern Cape, one of the poorest provinces of South Africa. Besides the presence of the university, there is another factor which makes Grahamstown an ideal place for ICTEd4D initiatives. Unlike in other South African settings, the township (areas, surrounding urban centres, that during apartheid were historically for black people only and while they are no longer restricted to black residents they are predominantly populated by poor black South Africans) is relatively close and accessible, with a relatively low crime rate by South African standards. This makes it possible for staff and students of all backgrounds to easily reach the township's schools by car or even using local taxis.

E-Yethu built on work to connect schools in the Grahamstown township using various last mile connectivity technologies (such as DSL, WiFi and WiMAX) in marginalised areas. This connectivity research was started in 1998 by the Telkom Centre of Excellence (CoE) in Distributed Multimedia. The CoE is a research unit hosted in the Rhodes University Computer Science Department and, although its primary focus is on multimedia communication, it has been the strongest supporter of the e-Yethu project. In 1999, a young researcher in the Education Department who was also an educator at one of the township's schools approached the CoE for technical assistance in implementing the use of ICT in her school. This encounter marked the beginning of a marriage between the two departments (Education and Computer Science) at Rhodes and a collaboration which lasts to this day. In the following years, volunteer staff and students in the two departments continued their engagement with the Grahamstown township schools at various levels. Most of the work included research, connectivity tests and ad hoc ICT training.

E-Yethu constituted itself as an organic association of people interested in the potential of ICT in a marginalised educational context. The group included university staff and students as well as local educators, but with no specific hierarchical structure. Updates on current work were presented and strategic decisions were taken at weekly meetings.

3.2 Project aims and progress to date

The aim of the e-Yethu project, as decided by the various people making up the association, is to: 1) aid schools in sourcing computer and other ICT equipment; 2) implement and support technical solutions suitable to the context; 3) provide ICT training for educators and learners; and 4) facilitate collaboration amongst schools.

Currently the e-Yethu project provides Internet connectivity, technical support and training to eight primary and secondary schools in the Grahamstown township. Computer facilities at the schools have either been sponsored through the CoE, local NGOs/Industry or directly by the South African government’s Department of Education (DoE). Of the eight schools, two computing facilities were sponsored by the CoE, three were sponsored by the DoE, two were sponsored by NGOs/Industry and one was jointly sponsored by the CoE and the DoE. CoE computer facilities consist of Edubuntu Linux Terminal Server Project (LTSP) servers which boot a number of thin client machines. This solution is cost effective and eases maintenance as there is only one computer in the school that needs to be maintained (the server). DoE computer facilities consist of thick client computers with an optional file server which runs the Windows operating system. These facilities are more complex to maintain as each computer in the school needs to be maintained (the server). DoE computer facilities consist of thick client computers with an optional file server which runs the Windows operating system. These facilities are more complex to maintain as each computer in the school needs to be maintained. The local DoE in Grahamstown has a technical support staff member who maintains the computer facilities at these schools while the CoE is responsible for the networking and Internet connection at all schools and maintenance at non-DoE sponsored schools.

Capacity building and transfer of technical skills has been a priority for e-Yethu since the beginning. In 2007 a large-scale computer literacy workshop was organised at Rhodes University, involving university students as volunteer tutors, and accommodated 200 educators from neighbouring marginalised schools. The workshop focused on the use of basic productivity software (word processor, presentation, spreadsheet, web browser) using open-source products (OpenOffice.org and Mozilla Firefox) such as the ones we support in schools. The main goal of this experience was to ensure most teachers in the area had at least an initial experience with computers, an e-mail account and that they were made aware of the e-Yethu project and goals. Subsequently, a growing number of educators have enrolled in accredited computer literacy courses offered either through Rhodes or as part of the ICDL framework. An Advanced Certificate in Education (ACE) focusing on the use of ICT in schools is offered by the Rhodes Education Department and is currently completing its third cycle. This is a part-time qualification and targets primarily educators in marginalised schools. The goals and curriculum of the course have become progressively more aligned with e-Yethu through presentations by e-Yethu members and practical activities involving learners in e-Yethu schools. ICT champions have emerged as key players in promoting the use of ICT in schools [9]. These are educators we can directly liaise with and who are willing to acquire technical skills such as basic troubleshooting etc.
E-Yethu has enabled local schools to participate in international collaborative projects involving the use of ICT. One of the schools initially involved in the project partnered with a school in Rome (Italy) as part of the Global Teenager project. The school was the overall winner of the project and won 16 computers as well as a sponsored trip to Italy for the teacher and participant learners [10]. Since 2009, schools in the Grahamstown township have taken part in Conectando Mundos, a project to promote global citizenship through ICT. The project is promoted by NGOs (such as Oxfam) in Spain, Portugal, Italy and Malta and involves approximately 160 schools in different parts of the world. This initiative attracted donations of ICT equipment to the participating schools and, over the years, has extended to a growing number of schools. SchoolNet South Africa, an NGO committed to the promotion of ICT in Education, has organised a series of workshops hosted by Rhodes University to equip educators with progressively more advanced ICT skills they can use in a school environment.

3.3 Lessons learnt

E-Yethu has attracted the attention of local media and some interest on the part of local government officials. Already in its initial phase, it established itself as a reference point for ICTEd4D in Grahamstown. However, an effective collaboration with the local offices of the South African Department of Education has not yet materialised. This lack of coordination is exemplified by the discrepancy between the software promoted and supported by e-Yethu (Edubuntu Linux and open-source in general) and that promoted and supported by the DoE (Microsoft Windows and related proprietary products). Although the DoE acknowledges our contribution towards the implementation of the national ICT-in-Education plan, there is little evidence of efforts to align our two approaches or even grant us access and administrative privileges to support the DoE equipment. This situation will inevitably be detrimental for all parties involved. In our experience, the choice of proprietary software over open-source introduces a number of additional complications for schools, such as the need to source free Microsoft licences (an administratively complex task), increased security risks and a more centralised control of the software by the DoE. Although we understand the attractiveness of widely used productivity software for both the DoE and the educators and learners in schools, we would like to work towards a situation in which both types of software are promoted and supported.

There is also little evidence of “buy in” by the University as a corporate entity. Like most organisations, Rhodes University has a roll-down policy for its ICT equipment. When computers are too old to be used within the organisation, they are donated to local schools and community development projects. In spite of its long-term presence and combination of expertises offered by e-Yethu, the project has never managed to establish itself as a reference for this type of initiatives. The fact that schools access the Internet through the University’s network also introduces some challenges. The CoE’s testbed network consists of a number of networking technologies, namely, DSL (connecting two schools), WiFi (connecting three schools, two of which have WiMAX for backhaul) and WiMAX (connecting three schools) - the testbed network grew organically in terms of incorporating new last mile access technologies as they became available and a need for their inclusion developed [10]. The testbed network peers with the University’s network and is able to make use of the University’s Internet connection, while separating the testbed network from the University’s internal network. Thus, the schools are not able to access internal University resources which for licensing reasons and network security are prohibited. The network routers, at each school site, connect to a PPPoE server at Rhodes University. The server terminates all incoming connections and routes traffic to its destination, which is either out onto the Internet or to one of the servers on the testbed network providing local services to the schools, such as email and DNS. Over time we hope to add additional services such as web hosting (for school web sites) and VoIP services to the schools. It is hoped that through the provision of local services we can facilitate inter-school communication and support structures to facilitate a broader community of practice amongst teachers across the various schools [10].

The production of research output is an important aspect of the project as it informs practice and helps to secure “buy in” by the funders and the University. The project and its members strive to provide research output in areas such as cost effective broadband network solutions for schools, sustainable ICT infrastructure for schools and meaningful ICT integration across curriculum [11]. Comparatively little evidence has been collected on the impact of the project in the community or in the schools. Our experience highlights a strong reliance on the group of volunteers from Rhodes and on the University's resources and venues. This is exemplified by the reliance on the University for connectivity and technical support as well as the use of the University's computer labs for workshops and as a “backup” when schools’ infrastructure fails. The latter situation presented itself during one of the collaborative projects mentioned above. Learners from a school had to be transported to and from campus in order to complete on-line activities and keep collaborating with peers on the network.
4. The Siyakhula Living Lab

4.1 Project history and background

The Dwesa Project involved a group of schools in Dwesa, a rural community on the Wild Coast of the former Transkei homeland. The area is of particular significance for a number of reasons. First of all, the Dwesa nature reserve, which extends for an area of 153 square kilometres along the coastline, was one of the first successful land restitution claims in post-apartheid South Africa. The process has been documented through extensive ethnographic research [12]. The nature reserve and adjacent areas also have potential for ecotourism and controlled agricultural intensification. Secondly, the area is the heartland of Xhosa culture and a centre for the production of traditional Xhosa art-craft, music and dance. As such, it has the potential to foster small entrepreneurship and attract cultural tourism. Despite these distinctive features, the Mbashe municipality where Dwesa is located is representative of many African rural areas in terms of endemic poverty, lack of services and infrastructure. Such an interesting combination of strong attachment to the land and to tradition on the one hand and of potential for development on the other made Dwesa an ideal site for an ICT4D project. The importance of developing ICT skills and their potential contribution to rural development as well as the preservation and promotion of indigenous knowledge and languages are recognised by the South African Government [3] and were perfectly aligned with the activities of the Dwesa project.

The Dwesa project started at the end of 2005 as a collaborative project between Rhodes University and the University of Fort Hare, a historically “black” institution, through the respective Telkom Centres of Excellence. Although the initial idea was inspired by the experience of e-Yethu, the collaboration across institutions gave it a broader scope and greater access to resources from the start. These were necessary to initiate an ICT4D project in a remote rural area, characterised by lack of infrastructure and physical distance from urban centres. Reaching Dwesa from the two Universities involves a six-hour drive, the last 40km of which on rugged gravel roads. A multi-disciplinary team of young researchers from various departments at the two Universities (Computer Science, Education, Anthropology, African languages, Communication and Information Systems) pays regular one-week visits every month. Activities include connectivity tests, ICT training, research on economic and social viability and impact, collection and classification of indigenous knowledge etc.

The project has since grown into the Siyakhula Living Lab (SLL). A Living Lab can be defined as “an approach that deals with user driven innovation of products and services that are introduced, tested and validated in real life environments” [13, p8]. The SLL is part of the growing Living Labs In Southern Africa (LLISA) network and is positioning itself at the centre of a growing network of interested stakeholders. For the industry partners sponsoring it through the Centres of Excellence, the SLL is a testbed to explore the possible deployment of telecommunication infrastructure and services in an African rural context. For government, the initiative is aligned with the promotion of education, rural development and technological advancement, which were identified as key strategic areas [14]. For the two academic institutions involved, the SLL represents an excellent opportunity to combine research, teaching and community engagement (an umbrella concept referring to social responsibility projects which South African universities are required to support). For the local community, the project provides access to information and skills which can improve various aspects of their daily life and can support other development projects [15]. The development of ICT skills in the local community is central to these interrelated networks of interests as it supports testing and use of technology for development and research.

4.2 Project aims and progress to date

From the technical point of view, the primary objective of the SLL is to develop and field-test a distributed, multifunctional community communication platform, using localization through innovation, to deploy in marginalized rural communities in South Africa. These communities, by sheer size and because of current political dynamics,
represent a strategic emergent market [15]. In order to support the project's objectives and provide the community with access to ICTs, a local loop access network was deployed to the Dwesa-Cwebe area. WiMAX technologies were used to build the local loop while VSAT technology is used to link the community to the Internet.

The communities access the SLL infrastructure and communications platform via the distributed access nodes (DANs) at five schools, where the DANs are hosted. Each DAN is equipped with a thin client computer lab running Edubuntu Linux and approximately 5 to 20 thin clients, depending on the size of the school's computer labs and the level of security available. At each DAN there is a community access point (CAP) which provides access to the local loop WiMAX network for all the clients at each site. The CAP is a FreeBSD router that is configured to manage and monitor the DAN through a number of services such as SMTP and Netflow to name a few. The local loop access network facilitated the strategic pooling of resources (specifically Internet access) across the schools and communities. In addition, the local loop network allows us to provide local services to the schools, such as telephony (via VoIP), email, and content sharing (sharing information, lesson plans, rubrics, etc). The network has made convenient communication possible between the schools and between their local communities. Greater detail of the network deployment and configuration can be read in [16, 17, 18].

Schools were chosen as points of access for three main reasons. First of all, they are often the only buildings in the area with electricity and with appropriate and secure infrastructure. Secondly, they are identified centres of community life and access to knowledge. Thirdly, as discussed above, the development of ICT skills and knowledge, which is aligned with the mandate of the schools, is crucial for the success of the project from the point of view of every stakeholder. As was the case in the e-Yethu project, educators in some of the schools identified themselves as ICT champions. Such educators have taken initiatives in furthering their ability to do basic troubleshooting and have initiated computer classes for members of the community. Course attendees pay a nominal fee which contributes to the running of the school's computer lab. Anecdotal experience suggests that a greater number of learners prefer to complete their studies in the area rather than move to boarding schools in urban centres. In these learners’ own words, this is partly due to the presence of computers and the associated improved status of local schools.

The SLL has attracted considerable interest by the media and by government officials at the local, provincial and national levels. The launch of one of our labs attracted representatives of national and provincial government to the area [19]. The collaboration with the local offices of the Department of Education is excellent. This resulted in the funding of an accredited computer literacy course and of an ACE ICT, similar to the one in Grahamstown, for a group of 20 educators from schools in the area. The courses are run to a large extent using venues in Dwesa (school classrooms and computer labs) to link classroom discussion to actual practice within the local context. To our knowledge, the offering of accredited courses of this nature in a deep rural setting is a first-of-its-kind in South Africa [20]. A large number of publications and research projects ensured that the SLL has great visibility at both academic institutions [21]. As mentioned above, the combination of engagement with the community, teaching and research output is important to obtain “buy in” by the Universities to keep the project alive.

4.3 Lessons learnt

The architecture of the network encourages collaboration and interdependency among schools. Four of the five schools rely on the fifth school, where the VSAT link is hosted, to connect to the Internet. At the same time, the latter school relies on access to the base station hosted at another school in order to make use of other local services such as VoIP and access to shared resources (off-line content). The reasons for this setup are both historical and strategic. The first school to join the SLL project was the logical location (at the time) for the VSAT installation. A second school (which joined the project at a later date) is on higher ground and offers better line of sight to most other schools involved in the project. For this reason, it hosts the base station to which all other schools connect. Unfortunately, the second school only joined the project a year after the VSAT link had been installed. It was decided that the VSAT unit should not be moved retrospectively to the second school in order to ensure that no one school was responsible for all the network facilities. Rather, the schools and communities need to work together, pooling their resources and collective capacities to jointly run and operate the network for the benefit of all.

A wide array of Industry and Government parties are participating in funding the SLL and an expansion to eleven more schools is imminent. The planning of the expansion took into account technical constraints as well as social and educational issues [22]. The educators in the ACE ICT course played a significant role in providing input on the latter aspects. This is an example of the synergy between the SLL and the ACE ICT. Other examples are the inclusion of a troubleshooting module for educators and the adaptation of the curriculum (originally based on Microsoft products and proprietary software) to open-source software. Such re-workings entailed considerable work but, in our opinion, contributed to an integrated approach to promoting ICT Education in a developmental context.

The SLL enabled participation in some of the activities mentioned above in relation to e-Yethu. Educators and learners in the area seem to have fared better and more independently than their counterparts in the Grahamstown township. This can be attributed to the physical distance, which requires schools in the area to be independent, as well as a stronger sense of ownership of the project by educators in the rural as opposed to the township setting. An example of such a sense of ownership was provided at the beginning of the project, when computers placed in one of the schools
were stolen. Members of the community visiting the lab reported having seen a similar “TV-looking thing” in a household nearby. ICT champions at the relevant school promptly confronted the thief and recovered the equipment. In our experience, nothing comparable has ever happened in Grahamstown, where two computer facilities were burgled over the years.

5. Reflections and conclusions

The levels of investment in the two projects are not nearly comparable, with far more resources having gone into the SLL than into e-Yethu. A comparison of the two experiences, however, allows for some reflections which seem relevant for ICTEd4D in general. The mere fact that the SLL, being based in a more remote and marginalised area, required greater initial investment highlights the first paradox: The more marginalised a school is, the greater the investment required to equip it with ICT skills and infrastructure. This consideration appears quite obvious and, one could argue, is one of the reasons why marginalised areas lag behind in the implementation of ICT. With respect to this, it should be noted that the collaboration between Rhodes and Fort Hare, which made establishing the SLL possible, would have been problematic in a less “neutral” terrain such as the Grahamstown township. The rural character of Dwesa no doubt contributed to attracting the interest of funders, the media and kept the young researchers motivated and involved.

A second, and more interesting paradox highlighted by our experience is that, given similar levels of access for educators and learners, ICTEd4D seems to have greater impact in the schools which are the most marginalised. This can be explained by the fact that access to information and resources through ICT is particularly important for communities which are disadvantaged in so many other ways. Working within the SLL framework, which emphasises participation and co-creation, meant that the educators and learners in Dwesa felt a greater sense of ownership of the project. Our experience shows that this contributes to security of the equipment, a key concern in ICTEd4D.

We are currently planning to extend the concept of the Living Lab to the schools in the Grahamstown township. Some key aspects will need to be considered and managed. First of all, the collaboration with Fort Hare in promoting ICTEd4D in the Grahamstown township will need to be carefully presented, not to give the impression that the resources of a historically disadvantaged institution are used to benefit an area close to a historically privileged one. The possibility of a sister site in an area close to Fort Hare, Keiskammahoek – where substantial development work is already underway, would address this issue.

From the point of view of the industry and government funders, a project coupling rural and township schools’ realities would cover most of the marginalised scenarios in South Africa. This should increase the possibilities of attracting funds. A second dimension is to ensure the involvement of educators, learners and surrounding communities. This is relatively more difficult in a township setting, where schools play a less prominent role as centres of community life than in rural areas. Nevertheless, the provision of sustained support and the promotion of initiatives in the schools could act as catalysts. From the point of view of the academic institutions involved, shaping research projects around the ICTEd4D initiatives is a crucial success factor. At present, most young researchers involved in Dwesa are students at the University of Fort Hare. Greater involvement of Rhodes students, willing to conduct research in the Grahamstown township is required.

Synergising a teacher development course (the ACE ICT) with the activities of the two projects was a key success factor. Such integration required substantial work and adaptation of the curriculum and, especially in the case of the SLL, overcoming considerable logistic challenges. However, securing the involvement of educators as ICT champions addresses problems of basic troubleshooting, motivation and involvement which are recognised challenges in ICTEd4D. In future, initiatives such as the ACE ICT will become part of the core activities of the ICT Education Unit at Rhodes University, in an effort to support the integration of the Grahamstown township into the Living Lab network.

References


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