

ICT IN NATURAL SCIENCE FOR EMPOWERMENT: STUDENT WORK OF A DIFFERENCE

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Abstract

In 1994 the South African democratic government was sworn into power. A new education curriculum was implemented to replace the redundant, racialised apartheid education curriculum. The Department of Education was concerned with developing a skilled and computer literate workforce for the progressive development of the country to meet the challenges of the 21st century. The research question asked in this research is – How can student teachers engage with ICT for the empowerment of disadvantaged (socially and economically deprived) communities? The theoretical framework that underpins this research is empowerment and authentic learning. The participants in this research were two groups of Biological Sciences student teachers who were registered for a research and service-learning module. The data collection methods included a document analysis of the Biological Science programme, the student work (PowerPoint and research report), semi-structured interviews with students and observation of their interaction with the community. The students used ICT in developing and using their knowledge and skills of research and service-learning at the particular placement sites to engage in empowering themselves with the communities. They also used ICT to communicate their findings for the development of themselves and the community. The personal and community empowerment aspects were expressed and discussed.

Key words: student teachers, ICT, empowerment, research, service-learning.

Introduction

In 1994, the South African democratic government under the leadership of the African National Congress (ANC) was sworn into power. Change in the economic, political and social dimensions of South African citizens' lives was expected. The apartheid laws with its related policies were abolished and all South African citizens irrespective of race, culture and creed had the right to vote and access to education. This was an imperative for developing the new democracy since there was a population of approximately 47 million people and 23.5% are illiterate (Isaacs, 2007, p. 4). The democratic government was concerned with enabling all citizens to have "access to lifelong education and training" (Department of Education, 1994, p. 11). Thus, the education policies were concerned with increasing access to school and, also the quality and nature of schooling for all children eligible to attend. The policy of free basic education to all was a very attractive and acceptable policy for most South African citizens. Inherent in this policy was the expectation that all schools would have an acceptable quality of education. The Department of Education was also challenged by reports of poor performance of learners in global TIMSS test where South Africa was at the low end of fifty countries. These challenges for quality education were also compounded by the challenge for educating citizens for the 21st century.

Globally, the quest for developing citizens for the information age was an imperative to be

achieved by the nations of the world. The South African Department of Education was concerned with developing a skilled and computer literate workforce for the progressive development of the country and for meeting the challenges of the 21st century. The South African Department of Science and Technology (DST) was also involved in this development as they viewed ICT as necessary for the progressive development of the citizens. According to Eksteen and Salojee (2011, p. 9) the aim of DST is to enable South Africa “to take full advantage of ICT and to contribute significantly to the progress towards an inclusive, sustainable knowledge society for all.” To this end a number of initiatives were introduced for the development of the South African citizens to access and use ICT. One such initiative is the Investment in ICT for Education Summit where county leaders are discussing the importance of and the development of ICT for all citizens. According to African Brains (2011) the organizers of the summit, it is essential to invest for ICT in education, and this is possible if there are partnerships forged between the education sector and private enterprise. One such example is the partnership between the Department of Science and Technology and Nokia where the purpose is on “stimulating entrepreneurial activity and high technological innovation, the collaboration intends to stimulate the interest of South African learners, cultivating the scientists and engineers of tomorrow” (DST, 2011, p. 1). Other initiatives focus exclusively on the development of girls where the shortage of girls in pursuing careers in Science and Technology fields is being addressed. According to Department of Science and Technology (2011, p. 1) this is done where “girls aged between 15 and 18 from disadvantaged communities will be placed in corporate mentorship and job shadowing programmes to give them first hand real world experience.”

Background to the Problem

For any country to survive into the 21st century, the development of knowledge and skills in ICT need to be integrated into the education system. In South Africa formal education is categorised according to three levels: General Education and Training from Grade R to 9; Further Education and Training (FET) from Grade 10 to 12 and Higher Education (HE) structures, which include universities and technikons. In 2009, there were 12 million learners who were taught by 386 587 teachers in 24 693 public schools; 386 098 learners taught by 24 557 teachers in 1 174 private schools (DoE, 2011, p.51). Many schools have inadequate infrastructure and supply of teaching and learning materials, limited or no access to potable water and proper sanitation facilities. The contexts outlined clearly impact on the ICT development of learners in that access to computers is limited or completely lacking in many schools.

The Department of Education adopted the e –Education White paper in 2004. A prime aim was for “every learner in the primary and secondary school sectors should be ICT capable by 2013” (Isaacs, 2007, p. 8). A number of challenges have to be confronted for this aim to be achieved. On the physical aspect of ICT availability Isaacs (2007, p.9) states that “of the 25,582 public schools in South Africa, 5,778 have computers used for teaching and learning and 13,011 have one or more computers for administrative purposes. This indicates a serious gap in the provisioning for ICT in the policy and the actual realities in the schools. A further planning document for the basic education level is the Schooling 2025, which states that “Much learning happens through the use of computers and from Grade 3 onwards all learners are computer literate” (DoE, 2010, p. 1). The focus of the policies is on learners use of computers but in the South African context ICT I argue should be encompassed with development of the individual and the community.

Currently, at Higher Education institutions in South Africa, the development of student teachers in the use of ICT, within undergraduate programmes is implemented. In the Faculty of Education, University of KwaZulu-Natal, one such programme focuses on Research and Service-Learning where student teachers develop and use ICT for the empowerment of

communities. The research question that underpins this research is: How can student teachers engage with ICT for the empowerment of disadvantaged (socially and economically deprived) communities?

The Researcher's Role

The researcher is the planner and coordinator of the Research and Service-Learning module that third and fourth year Biological Science students are expected to complete as part of their Biological Science programme for undergraduate student teachers. During this module the student teachers are expected to learn and use ICT to develop their knowledge and skills about what research and Service-Learning is and how to conduct these in particular communities and ultimately to present their experiences and interventions that they have planned with communities for the development of the community. The researcher engaged the student teachers in the ICT focused module and collected and analysed data on how the student teachers used ICT for the development of the community.

Theoretical Perspective

Service-Learning has been defined by various authors: some have focused on the service component, others on the learning component and others on an equal focus on service and learning. Service-Learning was defined by Sigmon (1979) as an experiential education. Furco (1996) highlights the use of the term Service-Learning by different organisations, "to characterize a wide array of experiential education endeavours, from volunteer and community service projects to field studies and internship programs" (p. 1). He views Service-Learning as seen in Service-Learning programmes, as "distinguished from other approaches to experiential education by their intention to equally benefit the provider and the recipient of the service as well as to ensure equal focus on both the service provided and the learning that is occurring". He further states that, "service learning programmes must be designed in such a way that ensures that both the service enhances the learning and the learning enhances the service".

In this article the meaning of Service-Learning used embraces both service and learning in a transformative manner, where student teachers are expected to be empowered to address community needs, and in the process empower community members. This meaning of Service-Learning is evident in the following: students develop a lifelong commitment to service and leadership and Service-Learning "promotes understanding of local issues as well as recognition of the interrelatedness of communities and societies across the world" (International Partnership for Service-Learning and Leadership 2007, p. 1). The focus of Service-Learning is such that student teachers and the community are expected to "equally benefit ... [and there is an] equal focus on both the service being provided and the learning" (Furco 1996, p. 1) on the part of the students. The focus in this research though is on the actions that the students and the community conducted for the benefit of the community.

Research on student teacher professional development focuses on engaging student teachers in Service-Learning and researching this engagement. Mettetal & Dé Bryant (1996) is of the view that we need to move beyond exploring the meaning of research, to include community action/activities that are directly related to one's academic expertise. According to Eyler, Giles and Braxton (1997), when students are engaged in Service-Learning they have a positive development in their attitudes, values and a better understanding of social issues. van Niekerk (2007) conducted research on student teachers engaging in Service-Learning in Adult basic education. He concluded that Service-Learning "enriches a student's total learning experience at a tertiary institution and provides opportunities for better closer public relations" (van Niekerk, 2007, p. 18). The students in van Niekerk's research expressed their enjoyment

of Service-Learning in that they took individual responsibility, their learning was practical, they shared ideas with many people, learning from others and the challenges that they experienced. These students also expressed the most significant things that they had learnt and what they came to realize. The students as a result of the Service-Learning realised “the importance of patience, challenging pre-conceived ideas, to be reliable and not to take simple tasks for granted and that everybody is a person” (van Niekerk, 2007, p. 16).

The theoretical frameworks that underpins this research is authentic learning and community empowerment. Learning may be viewed as a change in a person’s understanding and in his/her relationship to the world (Lombardi, 2007). It is also viewed as an active, social and sensory process that occurs effectively in authentic contexts (Van Huizen, Van Oers & Wubbels, 2005). Learning also has an active component in that it is “learning by doing [action] that is the most effective way to learn” Lombardi (2007, p. 2). It is in learning, that learners increase their capacity to act effectively in the world (Senge, 1990; Lombardi, 2007). Lombardi’s (2007, p. 2) view of authentic learning captures the real aspect of learning and it provides specifics about the nature of the problem and the strategies which are used for effective learning to occur. Authentic learning therefore requires real life problems; active learners, the achievement of an outcome and experiential learning in a real context.

Empowerment is a construct that is used in the field of psychology, community development, economics, education and social science and its meaning varies among these fields. Attributing a single definition to it may make attempts to achieve it formulaic or prescriptive-like and this would contradict the concept of empowerment (Page & Czuba, 1999). According to Bailey (1992 in Page & Czuba, 1999) how we define empowerment within projects will depend on the people and the context. Theorists view empowerment as a construct that links individual strengths and competencies, natural helping systems and proactive behaviours to social and political change (Rappaport, 1984; Perkins & Zimmerman, 1995). Empowerment, generally defined is viewed as a “multi-dimensional social process that helps people to gain control over their own lives” (Page & Czuba, 1999, p. 2). According to Page and Czuba (1999, p. 2) empowerment occurs at various levels, “individual, group and community.” In viewing empowerment, issues of wellness versus illness, competence versus deficits and strength versus weaknesses (Perkins & Zimmerman, 1995) are explored. Perkins and Zimmerman (1995) are of the opinion that “empowerment-oriented intervention enhance wellness while they also aim to ameliorate problems, provide opportunities for participation to develop knowledge and skills and engage professionals as collaborators instead of authoritative experts” (p. 570). In this research the view of individual and group empowerment was used where it focuses on the enhancement of the community in collaborative, participatory actions, where knowledge and skills are shared for them to be capable of taking control of their lives.

Methodology of Research

A qualitative, case study design was used. This qualitative approach was selected as the purpose of the research was to explore the enhancement of the community. This purpose is supported by Creswell (2003, 181) who states that “qualitative research is concerned with interactive and humanistic” aspects. The case study was used as it focused on “just one instance of the thing that is to be investigated... [and the case] is something that already exists, it is not artificially generated.” (Denscombe, 2003, p. 31).

Qualitative data is viewed as by researchers as significant and the data collection involves “documenting real events, recording what people say, observing specific behaviours, studying written documents” (Neuman, 1997, p. 329). It is for this reason that the student teachers were expected to record their experiences in a journal. Since engaging the student teachers in community enhancement projects is “education that is grounded in experience”

(Jacoby & Associates 1996, p. 9) the student teachers were expected to reflect on the process of this enhancement.

The case studies are descriptive accounts of the student teacher ICT activities in the module, including the community enhancement projects that they engaged in. Two student teacher case studies are presented: (1) module ICT activities and the project - young mothers and the feeding of their babies - An investigation of the factors influencing the nutrition of infants aged 0-12 months in the Inchanga area, and (2) module ICT activities and the project - young AIDS orphans at a Drop In-Centre - Exploring and developing the sustainable living or lifestyles of young children at a Drop In-Centre. The data collection methods included a document analysis of the Biological Science programme, student teacher reflective diaries, the student work (PowerPoint and research report), semi-structured interviews with students and observation of their interaction with the community. The data was electronically recorded. All the data for the student teacher cases was read. The data was analysed using a deductive approach (Cohen, Manion & Morrison, 2007), which focused on the actions of the students and the community for enhancement. It was then placed into categories which were previously decided by the researcher. The categories that emerged from the data were: collaborative, participatory actions, and development of knowledge and skills.

Ethical Considerations

Ethical procedures were followed in this research. Ethical approval for the student teachers to conduct the research in the various communities was sought from the University Research office. All participants in the research projects were asked to complete consent to participate in the research. All the ethical aspects were discussed with the participants before they were asked to sign the consent to participate form. All real names were changed and pseudonyms are used for the reporting of the research.

Results of Research

The two cases focus on the ICT aspects in the Biological Science module that the students were engaged with. I will present the first part of the two cases as a common section below. Thereafter I will present the two cases separately when I describe the ICT aspects of their particular projects.

Students registered for this module – Research and Service-Learning are expected to attend three 90 minute lectures for 12 weeks. The data about the programme was taken from the document analysis of the Biological Science programme. The organisation of the lectures in this module is such that students attended three 90 minute lectures per week for 5 weeks and for the next 7 weeks they attended one 90 minute lecture and worked at a placement site for three to four hours per week. During the first five weeks the module focused on developing students' knowledge and skills with regard to Research and Service-Learning, using ICT as the tool to develop this. Students in the first lecture were expected to access the internet to explore the meanings of Research and Service-learning so that they could have a conceptual framework with which they could work with. They presented these in a poster discussion session to the class group for the collective learning about these concepts. The meanings that a student from student group one shared was:

I realized that the meaning of research went far beyond my perceptions, I was glad that my understandings of the meanings were enhanced through the internet activity. I learnt that there is a central thread in everything that you do and that you need to ensure that you access as many internet sites to bring you to this point (Student reflective diary),

The next ICT focused activity was that the students had to access journal articles via

the internet on research and others on Service-Learning to develop the knowledge and skills of the processes and the contexts that they would be expected to undertake. Both research and Service-Learning were new processes to the students and it was imperative that they had to explore these via the journal articles accessed. A response from a student in the group to this activity was:

Accessing journal articles from the internet was not so difficult as I managed to find appropriate ones. I thought to myself, why can't the lecturer give us the readings, why should I spend time doing this? I soon realized that by looking for the articles I learnt more about accessing the internet, effective referencing and by reading the articles even though they were fifteen pages long I realized how other people conducted research on their Service-Learning (Student reflective diary).

In completing this activity the student from group two stated:

It is amazing how computer illiterate I was when I first started university. Now in this module we are expected to access journal articles and to use the computer extensively to develop the knowledge and skills required. I have forced myself to work carefully and to work with particular websites that I can access the research and service-learning articles from. It took me some time to work out how to do it, but now that I know it is simple (Student reflective diary).

In this section I present the two case studies as separate as the research projects were different for the two groups.

Case Study One

An investigation of the factors influencing the nutrition of infants aged 0-12 months in the Inchanga area. The students used ICT to access international and national literature on the nutrition of young children and being mindful of the issues of a developing country as would be expected for the South African context. In this context poverty is rife and the number of teenage girls who have young children is on the increase. Many of these girls have young children so that they can access the Child government grant. These students learnt how to design research instruments from accessing examples from the internet. They designed questionnaires for the young mothers to complete and they then analysed the data. The students were expected to conduct their research and service-learning for their project and present a PowerPoint on their project to the community of Inchanga. It was important that the data was clearly presented in an appropriate format. Table 1, is an example of the biographical data that the students compiled on their participants – mothers with children.

Table 1. Biographic data of the participants for case study one.

Mother	Age	Marital Status	Highest Grade completed	Income status	Number of children
M1	16	S	10	UGG	1
M2	20	S	8	U	1
M3	20	S	7	UGG	2
M4	21	S	9	UGG	2
M5	32	S	12	U	2
M6	21	S	10	UGG	1
M7	29	m	NS	U	5
M8	19	S	9	UGG	3
M9	20	S	NS	U	4
M10	22	S	10	U	1

The students analysed the data on how the mothers fed their babies. This data was presented in the form of a graph (Graph 1) where the number of scoops of milk that the mothers used for their child was compared against that for the actual amounts required per feed for each child.

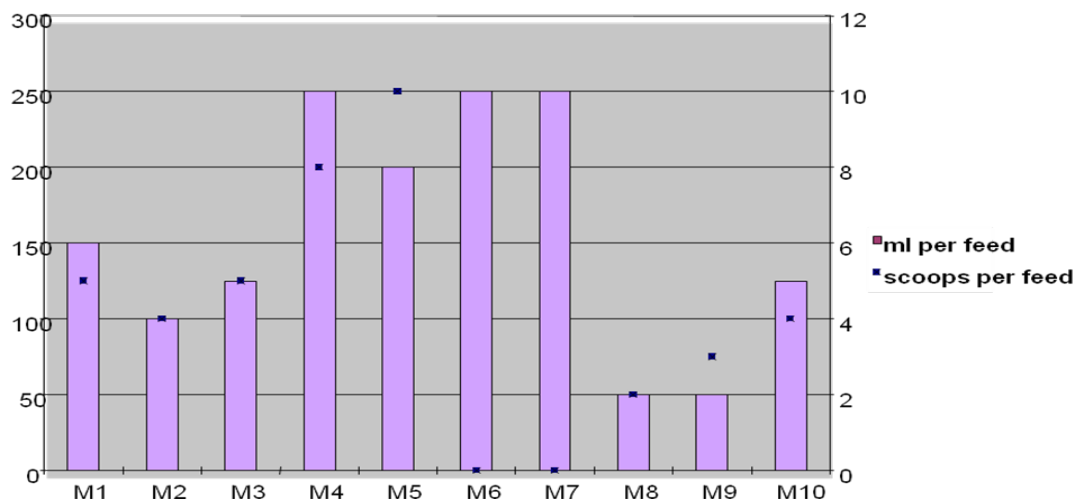


Figure 1: Findings of the research project – Mothers and nutrition of their babies.

The presentation of the findings were in the slides for the PowerPoint and the typed hard copy of the research project.

Case Study Two

Exploring and developing the sustainable living or lifestyles of young children at a Drop In-Centre. The students accessed journal articles on sustainable lifestyles in for children in developed and developing worlds. A feature that these students experienced was that the concept of a Drop In-Centre was peculiar to the South African community within which they worked. They were astounded that this concept was developed here and that it worked for the young children in that they were care for feight hours a day if they were from three to five years old by a trained housemother. They returned to their own homes at the end of the day where they were cared for by their older siblings or their grannies.

At the Drop In-Centre the students worked with the children on developing and sustaining organic food gardens. The children were assigned four gardens to create and maintain. They planted seedlings that the student teachers had purchased - beans, tomatoes, carrots and spinach. The students documented the children’s activities and recorded this in their project reports. Figure 2 is a visual of the gardens that the children developed and maintained. This was presented as a slide during the project presentation as evidence of the activities that the children were engaged in for their enhancement.



Figure 2: A visual of the garden developed by the children.

Furthermore, as the project focused on children adopting healthy actions, the children at the end of the project could identify the carbohydrates, protein and fat in their meal and talk very basically about the importance of these for their development. One child wrote the following: “Healthcare is about washing your body, changing your clothes and brushing your teeth every day. Is to choose the right friends. To seek help from social workers and the hospitals and keep the utensils clean all the time”. (Mtembi, research report, October 2010).

Students also identified and motivated for the placement site they wished to work at. Students then designed and presented a research proposal outlining what and how they would research their Service-Learning. During the next seven weeks students conducted their Research and Service-Learning projects and reflected on their progress.

Limitations

The limitations experienced was the lack of time for the extension of these research projects for the students. Essentially the project work was over a period of 7 weeks where they spent approximately three hours at their respective placement sites. This changed if there were transport problems especially when it rained access to the areas was not possible.

Discussion

The students used ICT in developing and using their knowledge and skills of research and service-learning to empower themselves before they could be expected to design and conduct an intervention type service-learning at their respective placement sites. The student’s engagement in the various ICT focused activities was done in a scaffold manner. They were expected to access websites to establish the meanings of research and service-learning. Accessing a website was not a difficult task as the students had accessed websites for another Biology module. Accessing journal articles was a new and different experience for the students. They were expected to use EBSCO search and the UKZN Researchspace to access journals for the knowledge about the processes involved in conducting research and also service-learning. Once they had developed the theoretical aspects they were then expected to actually carry out the authentic activities .i.e. the service-learning activities at the respective placement sites.

The student activities were done in a scaffolding manner in that the more simple ICT

activities were given before they were expected to do the more intricate activities. Support was provided to students during the class discussion sessions where any problem that they had with accessing information could be shared and discussed with the class group. An important feature of these activities was that they were student-focused, where the students took responsibility for working with the required material and they presented their responses to the class group. By using this strategy the students were being empowered not just in developing knowledge but also in the skill of using ICT.

At the particular placement sites the students were engaged in empowering the community by the initiatives that they had implemented. The students were viewed as collaborators in the process and not as experts as the community was engaged in deciding on how they should or could take control of their lives. Empowerment of the community is not external to the community but it is a construct that is developed over time in an environment where the community members are informed and enabled to take responsibility for their lives. The young mothers who were gave their babies one scoop of milk instead of a required five did this because they wanted the milk powder to last. The research findings, which were presented as a slideshow to the community was used to teach these mothers that a baby at a certain age (months) had to receive a particular amount of milk powder (teaspoons), and this had to be adhered to and then increased when the baby got older. The empowerment of the young children was in them realizing and acting on sustainable lifestyle activities where they developed the knowledge and the skill of gardening and the daily actions that they needed to follow for a healthy lifestyle, e.g., brush their teeth and wash their hands.

Conclusion and Implications

In South Africa the efforts of the government departments in developing a skilled and computer literate workforce is clearly evident from the various initiatives in place. These efforts cannot be achieved without the partnership of private business and by implementing and integrating ICT initiatives in education. Educating learners in ICT at the schooling level has a number of challenges linked to physical, economic and social aspects. Since many schools lack effective infrastructure it is not surprising that there will be no access to computers at these schools. The trend to follow is for Higher Education to be totally engaged in the development of computer literate citizens. This is possible if ICT focused activities are integrated into the various modules that students complete in the programmes that they follow. What is significant is that the activities should be for the empowerment of the students themselves and for communities as well. This empowerment should be both socially and economically meaningful for the community. **The integration of ICT in a Service-Learning and research programme for the development of a community is a necessary and important empowering process for both the students and the community.**

Exposing students to ICT in this information age is important but we need to consider what should be in place for the years following this. Since we understand that young people are exposed to the HIP-HOP generation it is important that we need to consider how this can be integrated into education of the youth.

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