

The Influence of Information and Communication Technology (ICT) in Improving Teaching of Environmental Education

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ABSTRACT The advent of information and communication technologies (ICTs) and its rapid growth in this century has caused some pressures in facilitating effective teaching and learning globally. Bringing ICT into practice has a role to play in facilitating and improving pedagogy and content knowledge. Therefore, this paper investigates the influence of ICT in improving teaching of environmental education. A descriptive survey research design was adopted with a simple random sampling technique to pick fifty-two samples from the target population. A validated structured questionnaire was used to elicit information from the respondents. The findings revealed among others that ICT can improve the teaching of Environmental Education (EE), and is a veritable tool to influence effective teaching of EE in rural schools. It was concluded that Information and Communication Technology (ICT) provides opportunities to explore new knowledge and creates a conducive teaching environment.

INTRODUCTION

The 21st century's global explosion in Information and Communication Technology (ICT) has obvious implications for the increasing utilization of ICT in schools. Traditionally, pedagogical development in schools could be enhanced where learning resources are provided to increase active learner participation. But now with the advancement in ICT, learners can have access to education materials especially where teaching and learning take place on the web. The driving force for education transformation is through ICTs (Fisher 2006; Nivala 2009; InfoDev 2015). ICT has become a part of the daily life, and hence, any teacher who fails to utilize ICT resources has become a living corpse. Overhead projectors and use of the Internet is a must in this 21st century.

Daniels (2002) stated that ICT has become an ingredient of survival for modernization and economic growth. Countries globally now understand ICT as a basic skill and entity, which forms a compulsory aspect of education. Many teachers are now embracing new technologies and have been concerned about how to improve learning through the more effective way and appropriate use of technology. The rate of Information and Communications Technology innovation diffusion in high schools classrooms

has not kept pace with other professions and even with the general environment (Cuban 2001). While a minority of educators have aggressively adopted the use of ICT in transmitting information to learners, the majority of educators in the rural high schools have not adopted or have rejected most ICT innovations and have maintained the traditional lecture based instruction format (Duderstadt et al. 2002).

Presently, the modern and contemporary method of teaching that promoted learners' full participation has been enhanced through the use of ICT. The availability of ICT infrastructures has empowered learners to take the ownership of what they have been taught in school. To promote e-learning and open and distance learning in this era warrants the use of ICT resources. Erah (2006) defined e-learning as using computers and the Internet to enhance learning. Rosenberg (2001) was of the opinion that the acquisition of skills and knowledge with appropriate application is called e-learning.

The gap between integrating ICT in educational settings has generated some concerns for researchers across the globe. This was as a result of inadequacy of ICT infrastructures and it has bedeviled effective teaching and learning (Drent and Melissen 2008; Hsu et al. 2008). Some educators welcome the use of ICT facilities while some are reluctant because of their age and atti-

tude towards it. In a study carried out by Adu et al. (2014), it was revealed that the role of ICT for education sustainability cannot be overemphasized. These determinants are usually technology related teacher characteristics where, for example, teachers' attitudes and self-efficacy are in focus (Herman et al. 2008). ICT has become an indispensable tool in today's technological era by making a great footprint in the lives of people. Its influence is the most important in education. The ICT facilities have become a contraption or an aid for teaching and learning in most schools almost throughout the world (Adeyemo et al. 2015).

There have been quite a few attempts to equip schools with ICT facilities in the South School Net South Africa (School Net 2006), dwell in promoting accessibility of ICT facilities in schools. The World Links for Development (WorLD), which is a networking program, has been providing ICT to South African schools where it is needed most (the Eastern Cape and Kwa Zulu Natal). This activity intends to publicize and provide professional training for teachers in developing countries including South Africa to improve their ICT skills. It is also to ensure that technologies are used effectively. The South African government has committed itself to improving the information and communication technology skills of its people and to bridge the gap, targeting the disadvantaged groups. This is in line with the New Partnership for Africa Development (NEPAD) to achieve a sustainable development in the 21st century (DBE 2003).

The South African Institute for Distance Education (SAIDE) has the aim of promoting nationally distance education by bringing different initiatives to promote expansion of distance learning programs with the use of ICT facilities. The main objective was to inquire the nature and extent of ICT provision in the schooling sector, soliciting how ICT is being used and to consider factors that could hinder the effective use of ICTs in schools. The South African government has participated in the global market place of ICT and the significance of education in promoting adequate participation of all stakeholders. It uses 'Technology Enhanced Learning' as a phrase to describe the implementation of technologies in teaching and learning for education purposes (SAIDE Report 2001).

ICT in Environmental Education

Educators have within their power, the opportunity to shift their own beliefs and understanding about new technologies and about their place in teaching Environmental Education. Utilization of ICT in teaching Environmental Education lends itself to a more participatory approach to learning (SchoolNet 2006: 2). Educators have been concerned with a paradigm shift from traditional methods of teaching to modern and contemporary methods of teaching in order to create effective learning with a conducive environment. There is usually available time for learners to use competitive and peer teaching methods to complete the assignment or project given to them by the educators. This will enhance self-development, skill acquisition and fulfillment on the part of the learners (SchoolNet 2006: 2).

Environmental Education has been embedded in most subjects like Natural Sciences in the GET Band. The main goal of Environmental Education in the National Curriculum Statement (NCS) is that learners develop methods in solving environmental problems (UNESCO 2009). Precisely, Environmental Education is part of the curriculum since it helps the learners to be knowledgeable of their environment and how to solve problems. Through Environmental Education, learners will be expected to have opportunities to develop skills such as questioning, observing and interpreting observation. ICT can be utilized for teaching Environmental Education by facilitating information.

With the revision of the Curriculum 2005 and the adoption of the National Curriculum Statement for General Education and Training (GET) came the need to refocus Environmental Education work in the curriculum policy document. This means that Environmental Education processes are now integral to all learning areas in the formal curriculum. These are held together by the principle of the National Curriculum Statement (NCS) that understands the interaction amongst healthy environment and individual rights (Adu and Galloway 2015). ICT is becoming more integral to the lives of South African citizens. There are many curriculum changes in South Africa, starting from 1997- 2012. The dissemination of these curricula needs the help of ICT facilities (DBE 2003). Learners also are expected to have access to relevant information through these facilities.

ICT can be utilized for teaching Environmental Education by facilitating information gathering and dissemination. Adu and Tella (2013) rightly pointed out, the application of ICT to curriculum dissemination will enable the learners to be more competent and acquire more skills and be creative. When learners engage with ICT facilities, it will enable them to develop full capacity for research and independent study. Society will not be left behind in benefiting from these learners when they graduate and go back to the society.

There is currently considerable interest within the field of Environmental Education in developing the learners' abilities to apply their knowledge and to solve environmental problems. Signs of improvement in using ICT still reveal significant shortcomings. These shortcomings together with the importance of developing ICT knowledge and skills have led to calls for light to be thrown on pedagogy (Adu and Galloway 2015).

In the light of the foregoing, this research focused on the application of new technologies in teaching Environmental Education, and aims to present a framework for ICT use in subject teaching based on understanding of theoretical issues, possible approaches and examples from practice. Teaching and learning through ICT is used to describe situations where ICT facilities become the whole teaching and learning environment by providing learning material and acting as assessor or a tutor. The traditional role for teachers has been as presenters of readymade information and as organizers of learning experiences. One way in which ICT can be used in the classroom is to take over these presentational and organizational roles. This has implications for both the teachers and learners, and the computer, by providing an additional source of knowledge, may reduce the dependency of learners upon the teacher.

There is learner autonomy in learning, which means the teacher no longer needs to adopt a didactic approach, but gain freedom to function increasingly as 'enablers of a quality learning experience' (Adelabu and Adu 2015). The teacher acts as a facilitator of learning drawing on a range of information sources, trusting in technology's ability to offer greater sufficiency and effectiveness of student learning, and ICTs' growing prevalence in society at large. Computer-aided tasks in Environmental Education of any kind can be more authentic than the traditional

teacher-centered tasks. For example, through the wide range of information sources that modern technology makes available, learners can be exposed to many opportunities, which open up spontaneity in learning in Environmental Education.

According to Daniels (2002), ICT has quickly emerged as a vital building block in the fabric of contemporary society. Virtually every country currently regards understanding ICT has been integrated as part of core issues in education. However, there is a prevailing narrow view that ICT only refers to computers and applications associated with computers. Tracing the evolution of ICT, Pelgrum and Law (2003) stated that, in the late 1980s, IT (Information Technology) came to replace the previous narrow conception of 'computer' because of its revolutionary capability to store and retrieve information, and thereby shifting from mere computing technology, which hitherto had been the domain of the 'computer' (Pelgrum and Law 2003: 5).

In order to be precise, effective teaching and learning of EE has been positively affected and enhanced by ICT (Yusuf 2005). A number of researchers have identified many benefits of ICT in promoting the quality of education (Al Ansari 2006). ICT has the ability to enrich, deepen skills, accelerate, motivate and engage learners to help relate school experience to work practices and create economic viability as well as enhancing pedagogical in classroom (Yusuf 2005).

Availability and Utilization of ICT in Environmental Education

The availability and use of ICT in EE have undoubtedly been beneficial to teaching and learning in almost every community, whether urban or rural. Learners in rural high schools can have access to education despite their geographical barriers. It also provides intrinsic motivation for the teaching process, which in retrospect has a positive impact on learners' performance and achievement. ICT usage significantly prepares learners for their future careers in the modern workplace where computers, the Internet and related technologies have become increasingly indispensable and commonplace (Yusuf 2005).

In addition to technological literacy, which is, the ability to use ICT effectively, En Adeyemo et al. (2015) have identified other job skills re-

ferred to as 21st century skills, such as digital age literacy, information literacy and global awareness, which learners can acquire through the use of ICT in Environmental Education. Emerging ICT tools offer new opportunities to develop some of the critical early literacy skills, the fundamental developments, which will affect many numbers of low literate learners in the rural areas to take advantage of educational opportunities presented to them through formal education.

As a tool, technology entails the use of a wide range of word processors, hardware, software graphic packages, databases, and spreadsheets among others. This 'group of hardware and software' does not have limited educational purpose, but rather it is designed to help extend the teachers' and learners' abilities to do work. The ICT theatre makes it possible for certain forms of large group presentation, and the overhead projector makes possible the presentation of texts and images to all those in the room. Adelabu and Adu (2015) identified that teleconferencing, email, audio conferencing, television lessons, radio broadcast have been used for different purposes in education (Adu and Gallo-way 2015). These are also thinking tools that educators use to integrate into teaching and learning strategies and encourage independent learning (Adeyemo et al. 2015).

Objective of the Study

The present study aims to find out the effectiveness of using ICT in teaching Environmental Education in rural high schools.

Research Questions

1. How does the adoption and integration of ICT promote effective teaching of environmental education (EE) in rural schools?
2. How can ICT effectively be used to improve the teaching of environmental education (EE)?

RESEARCH METHODOLOGY

Research Approach

A quantitative method approach is used in the study focusing on the relationship between

the use of ICT tools and how effectively they are used in teaching Environmental Education.

Research Design

A research design is the conceptual structure within which research could be conducted. It deals with logical problems through logical plans for getting from the initial set of questions to be answered to the set of conclusion about questions. This study adopted descriptive research design of survey type.

Population

The population for this study consists of educators in rural high schools within the East London District, of the Eastern Cape of South Africa.

Sample and Sampling Techniques

The study therefore focuses on simple random sampling and a total of 60 educators, both male and female were selected at random for this study, out of this number 52 questionnaires were adequately completed.

Research Instruments

The instrument used in this study is the questionnaire. Questionnaires allow each of the respondents to read and answer identical questions, which ensures consistency in the responses. Questionnaires were delivered personally to the educators of Environmental Education.

Validity

The validity has been motivated by availing the instruments to an expert and supervisor opinion, and their comments and advice helped the researcher shape the items in the questionnaire to collect data that increased its relevance, reliability and validity to answer the research questions for this study.

Reliability

To ensure reliability of the questionnaire, it had to be pilot tested. Pilot testing is a trial run of the study done for the purpose of testing the instrument and coming up with issues that have

to be addressed before the actual study is conducted. Cronbach alpha was used to measure the reliability and internal constituencies. It is commonly used when you have a multiple Likert questions in a survey and the reliability coefficient of 0.78 was gotten.

Data Analysis

Descriptive and inferential statistics were used. Descriptive statistics were used with a central position of a frequency distribution for a group of data, by using the mode, median and mean. Analysis of data was also represented in tables while inferential statistics (Chi-square test) was used to measure the effect between variables that are studied in the population. Chi-square is used to examine the relationship between the influences of ICT in teaching environmental education.

RESULTS AND DISCUSSION

Research Question 1: How does the adoption and integration of ICT promote effective teaching of environmental education in rural schools?

Table 1 presents the output from the analysis of descriptive statistics for all the factors that determine the adoption and integration of ICT tools in teaching environmental education in rural schools. The mean and the standard deviation

are the major determinants of the importance of these factors. The ‘max’ indicates the highest scale and ‘min’ represents the lowest scale selected with regard to that particular factor. The rankings of the factors that influence the adoption of ICT in teaching EE are presented in this table in order of importance. The most important factor, “*ICT can improve the teaching of EE*” has the highest mean score (3.94) and the lowest standard deviation (0.235). The least important factor, “*My school has proper procedures for communicating to students online*” has the lowest mean score (1.38) and significantly higher standard deviation (0.661). The results are in line with Adu (2015) that reveals the importance of ICT for education sustainability.

Research Question 2: How can ICT effectively be used to improve the teaching of Environmental Education (EE)?

Table 2 shows the group statistics with the means and standard deviations and the difference between male and female respondents’ perception of the importance of the use of ICT in improving teaching Environmental Education.

Table 2 indicated that the use of ICT was more common to male respondents as indicated by the high mean scores and low standard deviations ($m=3.96$, $SD=0.189$) against females ($m=3.92$, $SD=0.282$). Although female respondents’ recorded a lower mean score than male respondents, their mean score is above average revealing that the respondents agree about the

Table 1: Descriptive statistics on the adoption and integration of ICT in teaching environmental education

	<i>N</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>Std. dev</i>
ICT can improve the teaching of EE	52	3	4	3.94	.235
ICT offers opportunities to educators to obtain resources for EE improvement	52	3	4	3.92	.269
ICT plays a transformative role in teaching EE	52	3	4	3.92	.269
ICT enhances students’ participation and feedback to educators	52	3	4	3.88	.323
It is very important to work with ICT tools to teach EE	51	2	4	3.67	.622
Lack of autonomy to evaluate and use ICT in teaching EE	51	1	4	3.10	1.005
Teachers enthusiastically engage in ICT projects in teaching EE	51	1	4	2.78	.879
Readiness and confidence in using ICT tools in teaching	51	1	4	2.73	.918
Strategist exist to help teachers learn how to use ICT in teaching EE	52	1	4	2.62	1.013
Teachers are provided with training and professional development regarding using ICT	52	1	4	2.42	.723
My school has been connected to internet and computers	52	1	4	2.31	.875
My school has been able to acquire suitable software and hardware	52	1	4	2.23	.783
ICT tools are properly equipped in practice and study rooms to teach EE	52	1	4	2.00	.767
Adequate preparation for the effective usage of ICT tools in teaching EE	52	1	4	1.98	.852
Majority of educators have ICT equipment for use in their classrooms	52	1	4	1.85	.638
My school has proper procedure for communicating to students online	52	1	4	1.38	.661
Valid N (listwise)	51				

Table 2: Group statistics on how ICT improves teaching EE

	<i>Gender of the teachers</i>	<i>N</i>	<i>Mean</i>	<i>Std. deviation</i>	<i>Std. error mean</i>
ICT can improve the teaching of EE	Male	28	3.96	.189	.036
	Female	24	3.92	.282	.058
ICT plays a transformative role in teaching EE	Male	28	3.96	.189	.036
	Female	24	3.88	.338	.069
ICT enhances students' participation and feedback to educators	Male	28	3.93	.262	.050
	Female	24	3.83	.381	.078
ICT offers opportunities to educators to obtain resources for EE improvement	Male	28	3.93	.262	.050
	Female	24	3.92	.282	.058

effective use of ICT to improve teaching EE. Table 3 shows the independent sample t-test statistics on whether ICT improves teaching EE. The purpose of the t-test is to determine whether the differences will affect the effective use of ICT to improve teaching EE.

Homogeneity of variances was not assumed as revealed by Leven's test for equality of variances ($p=.015$) for ICT enhances students' participation and feedback to educators and ($p=.033$) for ICT plays a transformative role in teaching EE. Therefore, a two-tailed significance test was used. Although there were differences in the mean score of males and females regarding their perceptions of the importance of the use of ICT in improving teaching EE, the difference is not statistically significant because the value "Sig. (2-tailed)" is greater than 0.05. Table 3 revealed that "Sig. (2-tailed)" = 0.473 - 0.875, respectively.

The results of this analysis revealed that there is no statistically significant difference in the perceptions between male and female respondents regarding their view of whether effective use of ICT improves teaching EE. Therefore, effective use of ICT improves teaching EE. The results are consistent to conclusions by Chowdhury (2009), and Owusu-Ansah (2013). Their studies revealed that use of ICT improves education, and male and females have the same view of the importance of ICT on education.

CONCLUSION

The educational level of an educator does not necessarily influence the teacher's attitudes towards adoption and effective use of ICT tools. There is sufficient evidence that attitudes of the teachers play a significant role in determining their perception of the effective use of ICT tools

Table 3: t-test independent samples test on how ICT improves teaching EE

		<i>Levene's Test for Equality of Variances</i>		<i>t-test for Equality of Means</i>			
		<i>F</i>	<i>Sig.</i>	<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>	<i>Mean difference</i>
ICT can improve the teaching of EE	Equal variances assumed	2.161	.148	.724	50	.473	.048
	Equal variances not assumed			.702	39.141	.487	.048
ICT plays a transformative role in teaching EE	Equal variances assumed	6.288	.015	1.198	50	.237	.089
	Equal variances not assumed			1.150	34.857	.258	.089
ICT enhances students' participation and feedback to educators	Equal variances assumed	4.782	.033	1.063	50	.293	.095
	Equal variances not assumed			1.033	39.895	.308	.095
ICT offers opportunities to educators to obtain resources for EE improvement	Equal variances assumed	.099	.754	.158	50	.875	.012
	Equal variances not assumed			.157	47.480	.876	.012

in teaching EE. Flowing from the above, it can be inferred that ICTs can contribute to improving the quality of teaching. Most rural high schools in South Africa do not have enough ICT resources. ICT was not only an educational pedagogy but also a motivating mechanism for socio-economic development in a globalizing knowledge economy. ICT can be used to support learning environment by providing tools for discourse, discussions and providing online systems to scaffold learners evolving understanding and cognitive growth.

Information and communication technology (ICT) provides opportunities to explore new knowledge and creates a conducive teaching environment. It also furnishes educators with the chance of enjoying effective ways of communication, processing and solving problems. This may allow learners in turn to develop their cognitive skills. However, integrating ICT in education still lags behind in rural schools because of factors such as the inadequate infrastructure (Internet, software, hardware), lack of policies, teachers' perceptions and teachers' attitudes towards the use of ICT.

RECOMMENDATIONS

Educators' professional development is necessary in the area of ICT to enable them to be confident and competent and to develop positive attitudes and skills. It may be extremely difficult sometimes to "change" educators' belief systems. Some are technophobic to use ICT in the teaching and learning process in their various classrooms. As a matter of fact, the higher the age of the educator, the greater their resistance becomes.

It is important that the integration process is well managed by educators and that they are guided by policies. ICTs are tools, and they are in no position to fix a bad educational philosophy. Choices made by educational personnel must be made in terms of objectives and methodology before any tangible decisions are made about any ICT intervention. Despite the challenges outlined in this study, ICTs are being increasingly used in education in developed world. In order to reach out to learners from remote areas, there is the need to provide them with adequate and quality education, and equip teachers with a wider range of educational resources.

As policy implementers of ICT education at the coalface, South African educators in rural communities need to prioritize subject content knowledge while at the same time embrace the innovation, which comes with the integration of ICT. Capacity-building training programs designated for educators in rural schools seem to play a critical role, as the skills acquired will alleviate the current poor use of ICT resources in rural schools.

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