



NERA Journal

A Journal for the Namibian Educational Research Association

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The impact of the diffusion of ICTs into educational practices: a review of the Namibian situation

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Abstract

ICTs have been seen as the missing technologies in the development of Africa. Over the last decade we have witnessed the deployment of ICTs into various sectors in Africa, including education. This paper aims to evaluate whether the impact of the diffusion of new technologies into educational practices, in developing countries, and in Namibia in particular, has brought about any meaningful changes, knowing that educational planners all over the world are forced in one way or another to use new technologies as part of educational practices.

Moreover it examines with specific emphasis what is happening in Africa compared to where we are in Namibia, trying to answer the questions: Is diffusion of ICTs into educational practices something good or something bad? Is the educational system ready for such investments or just creating further digital divides between rich urban schools and poor rural schools?

The paper follows a methodological style of reviewing existing literature, as well as initiatives aiming toward diffusion of ICTs into Namibian schools and the role of government. It concludes in highlighting some of the current debates of the impact of ICTs in developing countries, and the educational sector in particular.

Introduction

The move from teacher-centred education systems to learner-centred education all over the world in recent years, contributes to the diffusion and use of ICTs in education. Education reform practices focus on equal access and quality of education, highlighting the importance of change in the education sector, through use of ICTs and equipping new generations with enhanced skills to operate in the 21st century also referred to as the "knowledge-driven world" (Hawkins, 2004:1; Inwent, 2004:1) This paper

therefore aims to critically evaluate the impact of the diffusion of ICTs into the educational sector in Namibia, trying to answer the questions: How good or bad has this impact been and whether the education system is ready for such an investment?

ICTs and Education in Africa

The uses of ICTs in education in both developed and developing countries are seen as increasingly widespread and continuously growing. While there is a great deal of knowledge about how ICTs are being used in developed countries, there is not much information on how ICTs are being introduced into schools in developing countries. In both developed and developing countries there is generally limited contact time per month using ICTs by both teachers and students, and even less time spent with reliable internet access. Contact time with ICTs and teacher- and learner/ICT ratios vary widely. ICT use in education in the developed countries, in the areas where one would expect to potentially see some of the largest gains – students acquiring information, demonstrating and communicating content understanding in specific school subjects – ICTs are used only rarely. Reasons for this include scheduling issues inhibiting access to ICTs, lack of congruence between curriculum demands and ICT use, and convenient access to ICTs. In developing countries there are a host of challenges too in the integration of ICTs into education. They include lack of ICT policies; lack of adequately trained teachers; poor telecommunications and IT infrastructure; and poor Internet connectivity. Addressing these issues will go a long way in addressing some of the challenges that are currently faced.

Research on ICTs deployment in Africa suggests there is a digital divide between Africa and the developed world. At the same time, however, there has been significant growth in ICTs in Africa. This creates opportunities for addressing some of the major educational problems the continent faces. The establishment of school networking projects in Africa is therefore an opportunity to bring youth into the global information society. The evolution of school networking initiatives in more than 23 African countries should be seen against this background; thus it is crucial to embrace and appreciate its potential for reducing the digital divide.

SchoolNet Africa

SchoolNet Africa (SNA) is an African-led, African-based non-governmental organization, which promotes learning and teaching through the use of ICTs in African schools, in partnership with national schoolnets in 28 African countries. The aims of SchoolNet interventions vary enormously across projects and regions. For some, the aim is to increase exposure to and awareness of computers through leisure or social use. Others require tangible changes to content and curriculum. Most aim explicitly for the improvement of communication and access to information through connectivity.

Applications of ICTs in African schools range from offering optional courses in computer studies to plans to introduce ICT as a compulsory, non-promotional subject for all learners from Grades 1–12, as is the case in Namibia. Some interventions work with specific student projects – examples include the 'Laws of Life' project of the Partners for Internet in Education in Ghana, and SchoolNet Namibia's Insect@thon project on the digital classification of indigenous insects. SchoolNet Nigeria, for instance, has a problem-based learning approach that is community-based and includes formal links with the United Methodist Church. Yet, others work towards national education goals for the development of the curriculum to include computer education, for example, the application of ICTs in schools and rural training centres in Lesotho (James, 2002).

Challenges facing ICTs in Africa

The principal factors that prevent schools from using computers as tools for teaching and learning are lack of national ICT policies, insufficient funds, insufficient numbers of computers, lack of computer literate teachers, lack of teacher competence in integrating computers into different learning areas, and the absence of properly developed curricula for teaching computer skills. The following are some of the areas that need to be addressed in implementing ICT projects in education in Africa:

- Policy;
- Partnerships;
- Infrastructure and connectivity;
- Curriculum development;

- Training; and
- Research, monitoring and evaluation

Policy

While many ministries of education around the world have made commitment to computerize schools, few have developed coherent strategies to fully integrate the use of computers as pedagogical tools in the classroom (Hawkins, 2004:3). The main impediment to sound development and the implementation of ICTs in education in developing countries and in Africa, in particular, remain the lack of policy frameworks to guide the whole process. ICT policies are a set of public laws, regulations and policies that encourage, discourage or regulate the creation, use, storage and communication of information. Some countries in Southern Africa have begun formulating broad ICT policies to cover a number of areas in which ICTs are seen to be important in terms of general national priorities (including sectoral applications such as health, tourism, mining, education, and e-government). Mozambique and Namibia, for example, have both instituted ICT policy processes, in which education and skills development are covered as part of a broader ICT policy.

Establishing such policies has clear implications for use of ICTs in education. It has the potential to set up a more receptive social environment in which effective educational applications can evolve, as well as eliminating wasteful duplication. However, if such policies are not carefully integrated with existing educational policies, they run the risk of leading to educational choices driven by technological preference rather than educational need.

Partnerships

From the onset, ICTs are a mammoth burden on any educational establishment, especially in developing countries. For governments to succeed there is solution (Hawkins, 2004:4) too many countries and especially to schools in rural areas. And while wireless technology VSAT (Very Small Aperture Terminal) is a viable solution as reported by the World Links program, the policy framework that requires this to happen in Africa is still non-existent. Permission to use VSAT must be granted by central government through ministries of information and telecommunications, but as it stands today very few governments would

rather have all these connections through their central systems, to ensure that information coming in and going out of the country is monitored.

By its very nature the ICT phenomenon is relatively new and extremely time sensitive. Available data, which are generally not as recent or as detailed as needed for many African countries, suggest that the majority of poor countries in sub-Saharan Africa are lagging behind in the information revolution. Not surprisingly, the quest for connectivity has been problematic and will require fundamental shifts in the regulatory environment, as well as renewed attention to public-private partnerships and social services. For example, developed countries have 80 per cent of the world's internet users, while the total international bandwidth for all of Africa is less than that of the city of São Paulo, Brazil (UNHD, as quoted in James, 2002). All 54 African countries now have an Internet presence (Jensen, as quoted in James, 2002). Few countries from the region are, however, able to keep pace with the developed countries.

Curriculum development

The development of local content is a goal expressed by several projects under Schoolnet Africa. The design and development of course materials must be seen as prerequisites. Though costly, these can be updated frequently and delivered rapidly. The development of local content is also posited for political, social and pedagogical reasons. It has been considered in relation to capacity, and whether or not the development of content is seen as part of the process of capacity building rather than purely as a product. Beyond new knowledge, capacity includes development in the use of ICTs as well as critical thinking skills through both developing and critiquing local and international content.

Training

For ICTs implementation to succeed in our educational sector, one of the areas to be addressed is the training of teachers or intermediaries so that end users, the students are assured of the total benefits. Without adequate training and preparation of teachers ICTs will remain a pipe dream in our schools. The International Institute for Communication and Development et al. (IICD) (2004:6) has recommended that teacher training can be carried out at two levels; both as pre-service and in service

training. However the shortage of resources for training teachers suggests that pre-service interventions should be a priority. The IICD however highlights that there is need to transform current teacher training colleges if pre-service ICT training is to become a reality. Current barriers to transformation in the teacher training institutions include lack of ICT infrastructure and a lack of ICT trained teacher educators.

Research, monitoring and evaluation

Research, monitoring and evaluation are critical in the process of introducing and implementing ICTs in the educational sector in developing countries. Without enough research and evaluation of the implemented programmes countries cannot make informed judgments on best practices. According to InfoDev (2005) there is consensus that insufficient attention has been paid to monitoring and evaluation issues of most ICT in education initiatives. Furthermore, many of the issues and challenges associated with ICT education initiatives are known by policymakers, donors and educators. However data on the nature and extent of these issues remain limited in most places because of the lack of monitoring and evaluation tools and methodologies dealing with the use of ICTs in schools and their impact on teaching and learning (InfoDev 2005)

Application and use of ICTs in Namibian education sector

The introduction of ICTs into the Namibian education sector is not new, as it remains a challenge of the information and knowledge-driven society that everybody in the world is battling with. Furthermore, several debates are taking place about availability and use of ICTs as part of the teaching and learning process, and educational planners are reminded in all development effort plans such as NDP2 and Vision 2030 about this important challenge.

The following focuses on the impact of the diffusion of new technologies into educational practices, with emphasis on whether this has brought about any meaningful change, and answer the question: how good or how bad?

Telecommunication and ICT infrastructure in Namibian schools

With a population of 1.9 million, a per capita income of N\$ 2000 per annum, teledensity for fixed lines at six to fourteen per 100 inhabitants, the total number of landlines in use, 127,400 with 223,700 mobile users, Namibia is doing fairly well considering its 15 years of independence (Mwilima, 2002:2; CIA World Factbook, 2004:9). However, the biggest obstacle is, that there is only one Telecommunication provider, Telecom Namibia, and one Mobile provider, MTC, with debates continuing on introducing a second fixed line provider, and a second GSM license (Miller Esselaar & Associates et al., 2001:67). Lee (2001:7) in a FAO report substantiates that this is indeed a problem in that "countries which have poor Internet access also tend to be countries with monopolistic national telecom policies and little or no service competition in the telecommunication sector."

In respect of the ICT infrastructure in schools in Namibia, there are currently 1500 schools with more than 900 which are off-grid, and which do not have access to electricity, phone lines, and libraries, with 116 secondary or combined secondary schools who already have an Internet connection within a computer laboratory with either dial-up or wireless connections. (Johnston & Monty, 2004:1; SIDA, 2004:9). According to Stork and Aochamub (2003:49), there were approximately 3000 PCs installed in Namibian schools in 2002, mainly provided by SchoolNet Namibia. Furthermore, a lot of efforts and plans are underway to improve the current ICT infrastructure in schools through solar power, wireless solutions, and open source software solutions, specifically targeting rural schools to try and bridge the gap between urban and rural schools (Johnston & Monty, 2004:1).

ICT training in Namibian schools is currently covered within four subjects, Basic Information Science, Computer Literacy, Computer Practice, and Computer Studies. However, schools are still faced with other obstacles in that teachers lack the necessary skills to teach ICT-related subjects, and a curriculum integrating ICT across the curriculum (Miller Esselaar et al., 2001:95). In reviewing the ICT infrastructure in Namibian schools, it looks promising due to all the efforts by SchoolNet Namibia, with financial support from the Swedish International Development Agency (SIDA), the National Institute for Educational Development (NIED), and tremendous help from other initiatives which will be discussed in the next section.

Initiatives toward the availability and use of ICTs in Namibian schools

There are several initiatives in Namibia which are all working towards improving ICT availability and use in the education sector.

SchoolNet Namibia

SchoolNet Namibia is the number one player in the development of ICTs and increasing ICT capabilities of Namibia's education sector. With financial support from donor agencies such as SIDA, SchoolNet is in a position of supplying schools with refurbished computers for computer labs, open source software, and wireless Internet solutions for rural schools.

Telecom Namibia supports SchoolNet through prioritising installations of telephones in rural schools. SchoolNet is also actively involved in installing and maintaining school networks with the help of volunteer students trained at the Polytechnic of Namibia (Miller Esselaar & Associates et al., 2001:96). SchoolNet is also a major player in an alliance, to promote ICTs in Namibian schools, called Global Development Alliance (GDA). GDA comprises of SchoolNet, USAID, Xnet, NIED, Peace Corps Namibia and SIDA, and aims to the development of computer skills and extend Internet access to Namibia's disadvantaged schools, through wireless and satellite solutions in partnership with Telecom Namibia (SchoolNet web site).

National Institute for Educational Development (NIED)

NIED, as part of the Ministry of Education, was responsible for the development of an Information Technology in Education policy in 1995. However, this policy was never implemented successfully and now this policy has been updated with a build up to its launch on 06 June 2005. The current ICT for education policy has a very vigorous implementation plan that incorporate various aspects from computer roll-out, training, to ICT literacy to mention just but a few. The ICT for education policy implementation plan is also supported in the Ministry of Education, Education and Training Sector Improvement Programme (ETSIP).

Failing to implement the first policy, hopes are high that the latest version will be a first step towards strengthening ICT courses and utilization of ICTs in schools, as part of curriculum structures.

NIED, as a government initiative, has become very active in promoting ICTs in schools through various donor funded projects hosted and operating from NIED such as LearnLink sponsored by USAID and an Initiative for Namibian Education Technology (Inet), which is a two year initiative by the Ministry of Education, Schoolnet Namibia, and USAID designed to speed up the adoption of ICTs within the Namibian education system (Inet). Other initiatives also operating toward strengthening ICT capabilities and professional development of teachers are Neta, GesCi, and World Teach through the help of Peace Corps, etc.

Namibian Open Learning Network Trust (NOLNet)

Nolnet was established with the aim to avoid duplication of resources and be in support of all that cannot undertake any formal institution-based training. It is particularly responsible for donating equipment and study materials to fill the gaps at the existing centres in the education sector at large (Miller Esselaar & Associates et al., 2001:102). All the efforts by these various initiatives to improve availability and use of ICTs in Namibia's education sector provide enough evidence that these technologies exist and are used. The question however remains: What is the impact of the diffusion of ICTs into the educational sector in Namibia: good or bad?

Impact of the diffusion of ICTs into educational practices

According to Orr (2003:1) "diffusion is the process by which an innovation is:

The Diffusion of Innovation (DoI) theory consists out of five stages: communicated through certain channels over time among the members of a social system", based on some decisions and actions as to whether to incorporate the new idea or not (Rogers, 1995:162).

- 1) Knowledge occurs when an individual is exposed to an innovation's existence and gains some understanding of how it functions
- 2) Persuasion occurs when an individual forms a favourable or unfavourable attitude toward the innovation
- 3) Decision occurs when an individual engages in activities that lead to a choice to adopt or reject the innovation

- 4) Implementation occurs when an individual puts an innovation into use
- 5) Confirmation occurs when an individual seeks reinforcement of an innovation-decision already made, or reverses a previous decision to adopt or reject the innovation if exposed to conflicting messages about the innovation (Rogers, 1995:162).

More specifically, the members of the social system can be categorised according to the level of decision-making and adoption that occur at each stage:

- 1) Innovators (Venturesome)
- 2) Early Adopters (Respectable)
- 3) Early Majority (Deliberate)
- 4) Late Majority (Sceptical)
- 5) Laggards (Traditional) (Clarke, 1999:1)

This theory is applicable to any situation where something new is introduced, in that there will be those who are aware, those who will resist at first, and eventually a certain percentage will learn and will transfer ideas given the right conditions. In Namibia there is also sufficient proof that some teachers are willing to learn, in that they already make use of ICTs as part of the teaching and learning process. Also through deployment efforts as part of the ICT for Education policy implementation plan, the focus for Namibia could be on the early majority for shaping the future of fellow Namibian educators.

Having looked at the diffusion of innovation theory and the stages it passed through before it reaches confirmation, it becomes crucial to look at its impact once it is used. Educational planners are forced through various development goals, policies, and plans to use new technologies as part of the teaching and learning process. Given the technological infrastructure of Namibia, the demands of the ICT policy, NDP 2, Vision 2030, educators in Namibia are also using new technologies as part of teaching to some degree. The question is how good or how bad? On the more positive side, there are several reported benefits of introducing and using ICT as part of the teaching and learning process. Laferriere, Breuleux and Bracewell (1999:2) argue that there are significant benefits in using ICT as part of the teaching and learning process, as long as teachers recognise the relationship between use of ICT and the overall curriculum. With reference to the Namibian situation, the ICT policy for education also stresses the importance of integrating ICT across the curriculum, rather

than teaching about ICT. Furthermore, there is need for thorough curriculum planning for successful integration of ICTs. At present the National Institute for Educational Development (NIED) is working hard at integrating ICT use for pedagogical benefits as part of curriculum reform practices to benefit all teachers in Namibia.

Haddad and Draxler (2005:9) claim that different ICTs do make some valuable contributions to various parts of educational development and effective learning through "expanding access, promoting efficiency, improving the quality of learning, enhancing the quality of teaching, and improving management systems". Furthermore, Haddad and Jurich (2005:37) elaborate on the introduction of ICTs for educational purposes and the resulting benefits, in that it brings about positive changes to teaching practices. Through successful deployment of ICTs into Namibian schools with emphasis on particular priority areas, Namibia will soon be in a better position to report on resulting benefits or challenges.

Lim (2005:1) critically looked at various research studies of ICT in education that have established that ICT "promotes higher order cognitive skills of evaluating arguments, analysing problems and applying what is learnt, but lacks detailed investigation of its socio-cultural context". Roberts (2000:1) looks at how the use of technology can enhance teaching and learning to improve student achievements and provide access to a variety of educational materials. With the successful launch of a multi-stakeholder e-Learning Centre (eLC) under the auspices of NOLNet, Namibia will be able to make headway in producing vibrant online educational materials for all to benefit in the near future.

Nonetheless, all the potentials of ICT for education cannot be realised without an effective educational policy in place, making concrete decisions about teaching with or about ICT, making sure the necessary infrastructure is in place, having more than enough relevant content, prioritise professional development, and decide on how it must be integrated (Haddad and Draxler, 2005: 13-16). Just as there are reported benefits of using ICTs as part of the teaching and learning process, so too are there some problems. In an attempt to highlight some of the negative aspects, Haddad and Draxler (2005:7) also caution about the demands ICT use place on teachers in that they need to cope with new technology use in their classrooms and know how to use various applications to enhance the teaching and learning process.

A Canadian Teachers Federation (CTF) (nd) article urges educators to take the "Why" into account before introducing technology into classrooms, thereby implying that technology is not the answer to all educational

problems, and should be critically appraised before implementation. Roberts (2002:2) also warns about the role of technology in the classroom in that "nobody should believe that technology is the quick-fix for what ails education". Against this backdrop highlighting the pros and cons of the diffusion of ICTs into educational practices, it is difficult to draw a concrete conclusion on how good or how bad, but there are certainly valuable reported benefits that educational planners in Namibia can benefit from as well, keeping in mind that there are also several challenges during the process of ICT integration into educational practices. With the realisation of the ICT for education policy implementation plan through ETSIP, writing of Namibia's own foundation level ICT literacy curriculum and training manuals, ICTs for pedagogical benefits, further marketing and development of the multi-stakeholder e-Learning Centre, Namibia is competing very well compared to other developed countries.

Impact of ICTs on educational quality

There is widespread belief that ICTs can and will empower teachers and learners, transforming teaching and learning processes from being highly teacher-dominated to student-centered, and that this transformation will result in increased learning gains for learners, creating and allowing for opportunities for learners to develop their creativity, problem-solving abilities, informational reasoning skills, communication skills, and other higher-order thinking skills. However, there are currently very limited, unequivocally compelling data to support this belief.

Even in the most advanced schools in developed countries, ICTs are generally not considered central to the teaching and learning process. Many ICT in education initiatives in developing countries seek to place ICTs as central to teaching and learning. One of the enduring difficulties of technology use in education is that people think of the technology first and then investigate educational applications of the technology only later (InfoDev. 2005).

Impact on student achievement

In general, and despite thousands of impact studies, the impact of ICT use on student achievement remains difficult to measure and open to much reasonable debate.

It is believed that specific uses of ICT can have positive effects on student achievement, when ICTs are used appropriately to complement a teacher's existing pedagogical philosophies.

Computer Aided (or Assisted) Instruction (CAI), which refers generally to student self-study or tutorials on PCs, has been shown to slightly improve student test scores on some reading and math skills, although whether such improvement correlates to real improvement in student learning is debatable. ICTs are seen to be less effective (or ineffective) when the goals for their use are not clear. Traditional, transmission-type pedagogies are seen as more effective in preparation for standardized testing, which tends to measure the results of such teaching practices, than are more 'constructivist' pedagogical styles.

In many studies there may be a mismatch between the methods used to measure effects and the nature of the learning promoted by the specific uses of ICT. For example, some studies have looked only for improvements in traditional teaching and learning processes and knowledge mastery instead of looking for new processes and knowledge related to the use of ICTs. It may be that more useful analyses of the impact of ICT can only emerge when the methods used to measure achievement and outcomes are more closely related to the learning activities and processes promoted by the use of ICTs (InfoDev. 2005).

Uses of ICTs for simulations and modelling in science and math have been shown to be effective, as well as word processing and communication software (e-mail) in the development of student language and communication skills. The relationships between in class student computer use, out of class student computer use and student achievement are unclear. In studies that rely largely on self-reporting, most users feel that using ICTs make them more effective learners. (InfoDev. 2005).

Impact on student motivation

There appears to be general consensus that both teachers and students feel ICT use greatly contributes to student motivation for learning. Students who use a computer at home also use them in school more frequently and with more confidence than pupils who have no home access. (InfoDev 2005)

ICT use in education

Placing computers in classrooms enables much greater use of ICTs for 'higher order' skills than placing computers in separate computer laboratories (indeed, fewer computers in classrooms may enable even more use than greater numbers of computers located in separate computer labs). There are few successful models for the integration of student computer use at home or in other 'informal settings' outside of school facilities with use in school. On a general level, appropriate ages for student ICT use in general are unclear. However, it is clear that certain uses are more or less appropriate, given student ages and abilities. Emerging research cautions against widespread use at younger ages. Evidence exists that use of ICTs can increase learner autonomy for certain learners.

A review of the research on impacts of ICTs on student achievement yields few conclusive statements, pro or contra, about the use of ICTs in education. For every study that cites significant positive impact, another study finds little or no such positive impact. Many studies that find positive impacts of ICTs on student learning rely (to an often uncomfortable degree) on self-reporting (which may be open to a variety of positive biases). Where ICTs are to be utilized to improve educational quality as measured by most standardized tests, few such gains are to be expected. With sufficient teacher training, and given the existence of a variety of enabling factors, ICTs can be used to impact the nature and types of learning in which students engage.

Conclusion

In conclusion our review of the literature reveals that Africa, in general and Namibia, in particular have made some considerable strides in introducing ICTs into educational practices. However, many challenges still have to be addressed, but at the same time governments and other stakeholders should build on what has been achieved so far. While developing countries might want to emulate what developed countries have achieved, the reality is that this is not easily achievable.

ICTs' infrastructure, training, policy, connectivity all have to be addressed within the African context and means of each country. Coming to the question of how ready we are in Namibia for such an investment, Namibia has achieved a lot and still more investment can be made by opening up the telecommunications sector to more competition, training more teachers

to handle the new technologies, and integrate the ICTs into existing curricula with the aim of improving overall educational quality. Through the ETSIP plan and the ICT for Education Policy Implementation plan, hope is expressed for large scale deployment of ICTs in the education sector to enable schools, colleges and universities to use and apply ICTs in all educational practices for its impact to be carefully measured, and determine whether it is worth the investment or not.

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