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The Role of Wireless Technologies in taking Education to Rural Villages in Developing Countries

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ABSTRACT

The development of wireless technologies has generated a considerable amount of excitement among practitioners and academics because it results in shifting the academic environment from traditional classroom restricted setting to open schools. The use of wireless technologies may be very important in provision of improved quality education for rural parts of the developing nations that lack a number of necessary facilities. The study conducted a survey among teachers in primary schools with specific focus on the challenges of the conventional classroom setting in rural Kenya. From the findings of the study a framework of utilization of wireless technologies is proposed to help overcome some of the challenges. The paper highlights the possibilities and potentials of the wireless technologies for various functions in the rural schools through the use of short message service (SMS), podcasting, video and mobile Web services among other approaches. The paper aims at providing a reference point for decision-makers, planners, teachers and administrators of developing nations to guide them to the world of wireless technologies.

Keywords: *Developing nations, Education for all, Quality education, Rural settings, Wireless technology, Wireless utilisation framework*

I. INTRODUCTION

Most developing nation such as Kenya face an acute shortage of teachers following the introduction of free and compulsory primary education and the waiving of tuition fees for all students in public primary schools six years ago [1]. In some schools, some classes have as many as 80-100 students [2]. Teacher to pupil ratios of one to 80 - sometimes 90 – have been recorded, an aspect that places a severe burden on the country's understaffed teaching force and worse more so in the rural areas [3]. When free primary education (FPE) was introduced, the enrolment significantly rose from 5.9 to 7.2 million. However, most schools were not equipped to handle the large numbers of students [2]. Many classrooms were filled to overflowing, with teachers obliged to conduct lessons outdoors. Out of the 1998 World Bank and International Monetary Fund (IMF) recommendations to restructure public institutions to streamline efficiency in Kenya the government was made to reduce human resources. This included a freeze on hiring new teachers by the TSC and this resulted in a significant shortage of teachers [2]. Pressure from International organisations as well as a nations' need to develop has pushed Kenya towards ensuring education for all (EFA). According to Sessional Paper No. 1 of 2005, the overall goal of education is to achieve EFA by 2015 in tandem with national and international commitments. Indeed Kenya was the first Education-For-All country in Africa to make primary education free. However, this led to an acute shortage of teachers that has dealt a big blow to the quality of education. Education for all does not mean simply students being exposed to the schooling environment. It is not about putting children in a classroom. It is about providing children with a qualified teaching professional in an acceptable teaching and learning environment. This has led to pupils missing out on many essentials teaching-learning services calling on professionals to think about what Information and Communication Technology (ICT) may offer.

ICT and its integration into the teaching and learning as well as training institutions, has the potential to greatly impact on the teaching profession while going a long way in the provision of the otherwise would have been missed services. One such ICT options is the wireless technologies. Wireless learning environments offer many educational possibilities that are not easily achieved in other learning environments [4]. One such option includes mobile learning. Mobile learning, sometimes referred to as `m-learning' or `handheld learning,' has contributed a lot in terms of technical issues as well as pedagogical issues for instructional technology [5]. From the start of modern distance education, researchers have examined the strengths and weaknesses of a learning situation where the teacher and learner are in separate places ([6]. Wireless learning approaches could be included in many of those strengths. A number of studies have looked at what kind of trade-offs are involved with taking learning to wireless devices. With the advantages of mobility, wireless technologies improve efficiency and effectiveness in teaching and learning [7].

Applications of wireless technology in education can provide benefits to both students and educators [8]. Wireless technology provides greater flexibility in student learning. Students can have access to educational materials

through their mobile devices, which enable them to learn as and when the need arises and when the time is right for them, no matter where they are or the shortage of human manpower giving the very quality education across the board. With wireless devices, educational materials are not only readily available to students but they can also be delivered to students based on their needs and preferences while ensuring quality. Wireless technology can also benefit the educators by providing a new means of education delivery, as well as adding a new dimension for student-teacher interaction. For example, wireless classroom response systems can be integrated into classroom instructions in the rural settings to gather students' responses and provide instantaneous feedback to students. The use of wireless technology has not only extended desktop-based online learning environment into the mobile and wireless channel but also enabled education to take place anytime, anywhere [8]. Use of ICTs can offer a rich choice of learning experiences that are appropriate to needs, space, pace, aspirations and learning styles [9]. Learning and training could become interactive in contrast to the one way delivery system of traditional face to face teaching [10]. As a phenomenon that is gaining popularity, mobile technology in education has generated significant interest and attention from both researchers and practitioners [11], [12].

The paper explores the possibility of wireless technology in fostering quality education in rural set up. In particular, it describes the educational opportunities of a wireless school environment using mobile phones, notebooks (laptops) and Personal Digital Assistants (PDAs). Thereafter, the paper proposes a framework which identifies the general use of wireless technology in education and the specific activities that they encompass.

II. STUDY OBJECTIVES

The general objective of the study was to determine the Kenyan teachers' perception of the quality of education in the rural settings and based on the findings propose a framework of integrating wireless learning technologies enhancing the learning teaching propose in the rural schools. The specific objectives of the study were as follows:

(i) To determine the teachers' perception of quality of education being offered to learners in the rural settings

(ii) To propose how wireless technologies may be used to enhance the provision of quality education in the rural villages in developing nations

III. METHODOLOGY

The study used the descriptive survey design. Using questionnaires and interviews the primary teachers' perception of the quality of education in the rural settings was assessed. The questionnaire was administered on one hundred teachers in Bungoma County, Milo Sub-location. An interview was conducted with ten head teachers in primary schools. The questionnaires were administered at different times to the different groups and schools. The interviews were conduct two weeks after the questionnaires were responded to.

The questionnaire returned by the teachers was seventy eight out of giving a return rate of 78%.

Findings and discussion of the study

The first objective of the study was to establish the quality of education in the rural areas as perceived by the teachers. This was done through a number of items aside from asking them their perception. This included establishing the teacher student ratio, individualized attention, adequacy of resources, and feedback levels. From the findings then a proposal of how wireless technologies would come in handy was made.

Teachers' perception on quality of education

Teachers within the study on the overall think the quality of education learners are receiving in the rural setting is of relatively low quality. 63 % of the teachers' are of the opinion that the education is of low quality with only 9 % believing that it was of high quality as shown by the figure 1.

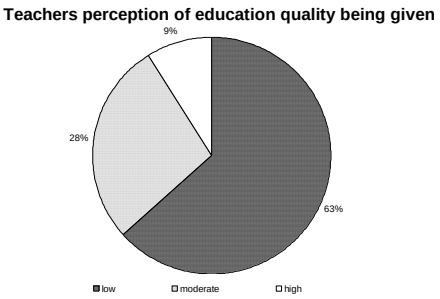


Figure 1: Teachers perception of the quality of education in the rural areas

This perception is not surprising bearing in mind that response to a number of other related surveys items build towards it. The main factor contributing towards this was related to overcrowded classes that had other related complications. Responses in line with the teacher student ratio reveal that on the overall the ratio is high as attributed to table 1.

Table 1: Student-teacher in numbers in eight selected schools

School	Total students	Number of teachers	Teacher student ratio
A	1145	17	1: 67.35
B	552	12	1: 46.00
C	1120	20	1: 56.00
D	967	17	1: 56.88
E	674	10	1: 67.40
F	1187	19	1: 62.47
G	1034	14	1: 73.85
H	648	12	1: 54.00
Total	7327	121	1: 60.55

On average the teacher student ratio is high, one teacher to sixty one students. The average ratio therefore is above the country's recommended ratio of teachers to students at one to forty five [1]. In such circumstances definitely the quality of education gets compromised. Many teachers conceded that due to the high numbers and pressure to attend to the learners, they indeed paid less individualized attention to students. Many stated that they were so demoralized out of being overworked. 79% of the teachers agreed to the fact that the classes were overcrowded with only 9% thinking that the classes were not overcrowded. The figure 2 gives the exact numbers of how the teachers responded.

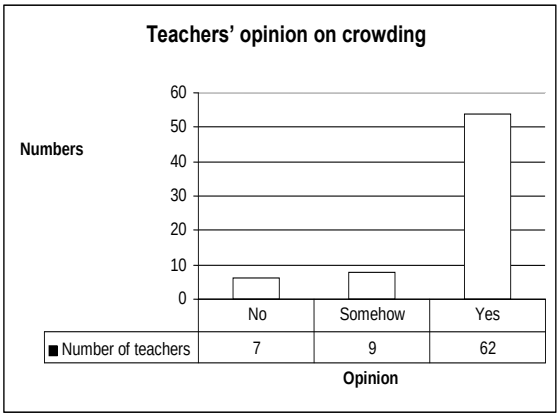


Figure 2: Opinion of teachers with reference to student crowding

Quality of education is also determined by the quality of evaluation of the teaching learning process. Only 3% of the respondents were able to undertake quality evaluation with 76% being unable to undertake the same as can be seen from the figure 3. 10 of teachers did not respond to the item.

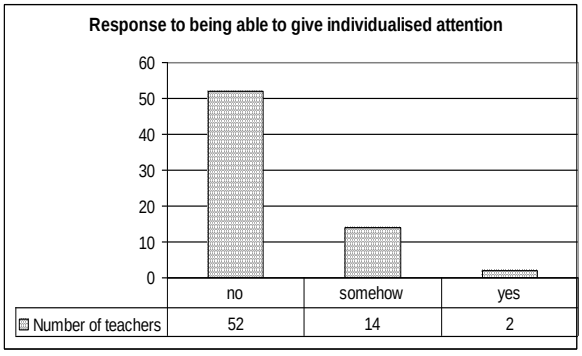


Figure 3: Teachers response to being able to give individualised attention to learners

This is complicated further with the realization that the overcrowding has impacted negatively on the teaching learning resources that are inclusive of learning materials, writing materials, and audio visual aids amongst others. This is implied from the response shown in figure 4.

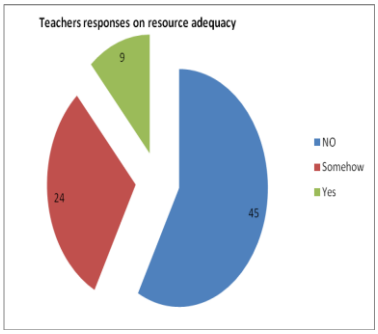


Figure 4: Teachers response to adequacy of teaching learning resources in schools

Quality of education is also determined by the quality of evaluation of the teaching learning process. Quality evaluation implies having feedback to students work. In this respect only 8% of the teachers were able to undertake quality evaluation giving their learners feedback. 39% of the teachers were unable to undertake the same as can be seen from the figure 5.

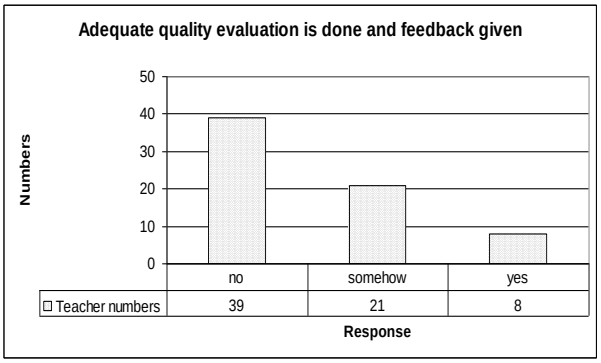


Figure 5: Teachers response to being able to give quality evaluation and feedback to learners

IV. THE PROPOSED FRAMEWORK

The second objective of the study was to propose how wireless technologies can help enhance the quality of education in the rural settings in Kenya. According to Rajala [13] application of wireless technologies brings with it the following advantages:

- Portability. Laptops are fairly lightweight and can easily and conveniently be wheeled from room to room or be moved to wherever student learning is taking place while PDAs and mobile phones fit inside the pockets.
- Provided one remains within the range of the designated wireless base, students can use wireless laptops or PDAs to access the Internet from just about anywhere.
- Time savings. Think about how much time is in a class period, and then consider the time lost by having students

go to and from the computer lab. You gain valuable learning time when the technology comes to the students.

The adaption of ICTs is regarded by many as the solution to a range of educational problems [14]. Global reforms in education and challenging ICT demands have made a remarkable shift in the structure of the enabling ICT environment and the utilization of ICT technologies in education in the developed worlds. The business community in Kenya has applied technology in its day to day activities finding it to be more than handy in its activities and thus seriously indispensable. Following the lead of businesses, the education community is embracing the use of technology. Wireless technologies seem to have taken all segments of the market by storm (Siau, Nah 2006). Wireless technologies are inspiring educators and learners with their flexibility and adaptability to various and multiple education environments. Wireless technology in education offers a range of advantages over traditional activities, such as reducing absenteeism, raising student self-esteem, enabling young learners to develop new skills more quickly and providing opportunity for professional teachers' development. In Kenya however, Schools have been slower to adapt to these changes for reasons including educational conservatism, bureaucratic systemic constraints in the provision of equality of opportunity and economic stringency. Although the Government of Kenya has now placed a high premium on the efficacy of ICT as a tool of development, it is yet to fully exploit the potential of the sector in education [15]. In this breath the proposed alternatives can bring forth the benefit to the rural based schools and the Government as well.

Liu [4] correctly stated that mobile devices enable both the teacher and students to employ computing power without time or location constraints while the Internet and wireless technologies enable mobile devices to interconnect seamlessly with each other or with other computing devices. Wireless learning users have access to real-time data whenever and wherever they need it, in addition to gathering features like note taking, imaging, audio recordings, videos, teacher lecture notes, books, encyclopedias, simulations, worksheets, etc., [16]. The figure 6 shows the various scenarios that mobile devices can be employed to promote education in higher education.

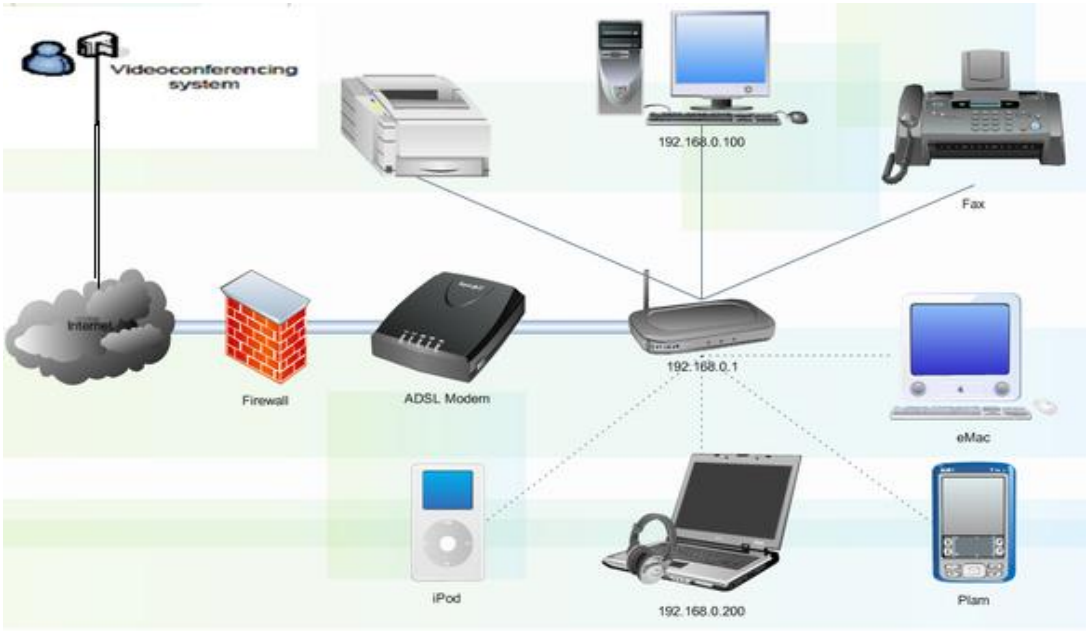


Fig. 6: Wireless learning possible option structures (Adapted from Omieno et al. 2011)

From figure 6, gives the learning environment consisting of a digital board, Personal Computers, videoconferencing system, mobile phones, PDAs and iPods. Within this kind of environment learners in higher education settings have option of searching the multimedia repository having video and audio content of lessons, in addition to the material that digital board can store electronically. The advantage of this type of learning environment is that it can be more than one, geographically distributed. Within this scenario, lecturers available can avail their lessons and have them passed through a computer system via the computers and the broadcasted to students via wireless devices.

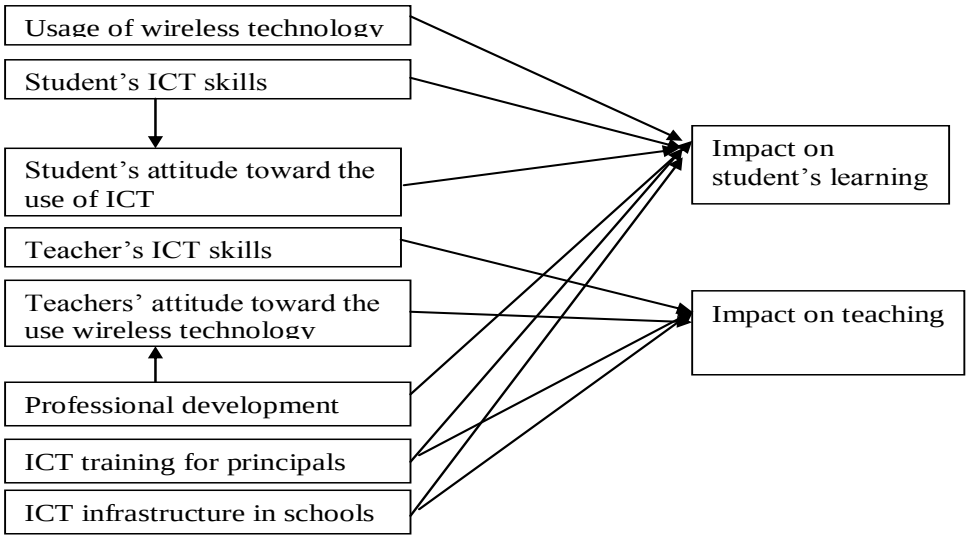
Some may capture the lesson through PDAs having Webcam facility while others through the Digital board. The SMS centre can be used to facilitate direct interaction between learners and teachers. Here the lessons are managed by the a teacher at the school level

irrespective of the subject being given for as long as the teacher has the ability to ensure that the technology is functional. Wireless modems are used with PDAs to link to the Internet to partake of the lessons being transmitted as well as get information. A simple phone with a built-in FM receiver can be put in some location to benefit from e-learning. The station would have an FM transmitter as a terminal capable of transmitting within a few meters the audio signal. The laptop from which the link is made is fairly portable thus enabling the link to the external while at the same time allowing its use at different points at different timings hence making it possible for lessons take place at different times within the same region. This would enable sharing of resources though it may initially need combined effort to purchase a PDA with relevant capability. With the approach and use of mobile and wireless technology, it's evident that such uses can help to improve classroom interactivity, enhance teaching effectiveness, and promote student learning.

V. RECOMMENDATION ON HOW TO INTEGRATE WIRELESS TECHNOLOGY IN EDUCATION

Keeping pace with new technologies and integrating them into existing institutional structures is only one of many pressing problems facing many schools in developing countries today. However, recent attempts to enhance learner-centred education through technology in Kenya are likely to lead to a successful holistic approach. One of these technological developments is wireless technology.

From the studies finding during the interviews with teachers the paper propose the use of the framework given in figure 7 in the planning of integration of the wireless technologies into the teaching-learning environment in schools. A framework which will take in consideration the usage of the wireless technologies, the skills of the learners and the teacher, the attitudes of the learners and the teachers, the school and educational administrators and the infrastructure in order to ensure successful use. These variables can play a major role towards achieving or failure to achieve despite the much funds that can be pumped into the project.



The Figure 7: A conceptual framework that can be adopted

VI. CONCLUSIONS

On the overall many teachers think the quality of education learners in the rural setting are getting is of low quality as a result of overcrowded classes as well as limited resources. This calls for thought of what ICT may offer to fill the gap though it may initially be an expensive undertaking in the short term though not in the long term. Use of ICT in the learning environment in the developed economies is being realized to a good extend. This is not so in developing nations, where ICT integration in education is considerably more recent, small-scale and experimental [17]. If appropriately utilized, ICT holds a world of solutions to the many challenges facing the education sector.

It is not in doubt, however, that ICT has the potential to play a more powerful role in increasing resources and improving the environment for learning [17]. ICT also has the potential to improve greatly the accessibility of education to all irrespective of place, time and shortage of resources. Wireless technologies that are inclusive of mobile phones have great potential and are fairly affordable in many developing nations. Mobile devices enable both the teacher and students to employ computing power without time or location constraints [4]. However, these very mobile phones have raised a lot of

debate and seem to be very controversial within the schools. Love them, or hate them, the chances are very high that students already own cell phones. Instead of burning them in schools it is better to consider how best they can be used positively thus integrating them into the classroom routines. Since the students already own this technology, and need very little teaching on how to use it, educators need to think of how to take advantage of the opportunity that they present [16].

Wireless learning environments offer many educational possibilities that are near impossibility to achieve in any other learning environments. Wireless learning environments have the following features based on its ability to link to various computing powers with mobile learning devices: (i) enhancing availability and accessibility of information networks; (ii) engaging students in learning-related activities in diverse physical locations; (iii) supporting group work in projects; (iv) improving communication and collaborative learning in the classroom, and (v) supporting quick content delivery [4]. The paper within this context has proposed a framework within which the wireless technologies may be integrated into the rural settings learning.

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