Digital Pedagogy: Augmented Reality In Kenya

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Abstract: This paper is a critical reflection on the current application of online and digital pedagogy in Kenyan as an emergency response to Covid_19 pandemic. The author deeply regrets that even though there is a variety of augmented-reality technologies which are at the disposal of teachers in Kenya, there are myriad obstacles facing online and digital pedagogy. A special focus need to be directed to the capacity building of the pedagogical agents at all level of education; the primary as well as secondary teachers, tertiary educators as well as university lecturers. This paper was inspired by a study sample of 36 teacher educators and 24 tertiary educators who were randomly selected from public institutions at the ratio of 3:2 respectively. The study adopted the descriptive method and the research instruments used were questionnaires and observation check-list which were well designed to achieve the study objectives. The study concluded that despite the availability of augmented reality technologies to enhance digital pedagogy, teacher educators, tertiary educators and university lecturers in Kenyan were ill prepared to adopt digital pedagogy as their method of teaching. The study also revealed that teaching online had more obstacles than anticipated and it could not serve as a viable solution to respond to the emergency caused by Corona virus pandemic.

Keywords: Augmented-reality technology, Digital divide, Digital literacy, Digital natives, Digital pedagogy.

I. INTRODUCTION

Over the last decade, development of augmented-reality technologies has leapt forward in the world (Yuen, S.C.Y., Yaoyuneyong, G. & Johnson E. 2013). The Kenyan society, just like the global community, has not been left behind in this digital migration in all sectors of economy but the pace has been slower than expected. In education sector, digital literacy has always been an agenda for the ministry of education but the impeded deliberations have thwarted the implementation of digital pedagogy. With the intrusion of Covid-19 pandemic in the country, there was a rush to the online teaching as the government tried to reach out to the scattered learners who were spread out all over the country to their respective homes. The renewed calls by the government for professionals in all sectors to continue working virtually from home did not favour the teaching profession. As a result of this teachers across the country were expected to hustle for their own devices and reach out for learners who were at large. The hustle of using augmented reality technologies as well as online services dawned as a new world to teachers who were struggling to fulfill their mandate virtually through digital classroom control and online management of learners.

The teachers were expected to use their personal mobile devices such as smart-phones, laptops and tablets to continue with classroom activities and to fully engage the learners who were quarantined at their respective homes. As a response, parents were expected to provide and support their children with digital devices that match with their teachers' and together with that they were also to provide internet connectivity. The assumption was that digital content was readily available and accessible from the Kenya Institute of Curriculum Development (KICD), and the teachers knew how to navigate and manipulate this content. The augmented reality here is that while there is a widespread use and applications of varied digital gadgets, a good deal of teachers as well as their learners, were lacking either the actual devices or technological knowhow to navigate through them. On the same note, a good number of teachers in our institutions were not ready to engage the learners through this method since the operation cost was too high to sustain.

Learners on the other hand despised their teachers who displayed digital naivety or technological handicaps in the navigation and manipulation of the digital content. Some even accused teachers to their parents as being digital strangers who were seriously challenged technologically. The learners today are digital natives and they belong to a different world from that of their teachers hence, teachers should make a big stride in order to manage their learners and harness the learning experience.

Researchers as well as educators have explored the potential of digital technologies, collectively branded as Augmented Reality (AR), to improve aspects of teaching and learning (Yuan et al, 2011). They have designed projects and pedagogical approaches suitable for use with augmented-reality technologies. Simultaneously, they have concluded that in fact, there is a great potential of augmented-reality technologies for promoting ubiquitous learning, immersive learning experiences, and discovery-based learning.

Globally, the digital migration continues to be embraced. This is demonstrated in part by the rapid spread and adoption of smart-phones, smart-pads and other advanced devices used in learning. The Augmented Reality (AR) is on the verge of becoming a ubiquitous component of people's daily lives. In other words, teachers should be able to use technology in order to superimpose virtual content into learners' perceptions of the real world in real-time. In order to fit fairly well in the contemporary society, teachers should be able to use a variety of technologies for interacting with learners as well as the outside world.

Today, there is a great deal of educational technologies which are available for use and these continue to grow at an accelerating rate. These technologies offer an unparalleled opportunity to change the way we live with, perceive, and work with information. However, due to the magic of Augmented-reality technologies and a perception that they require extreme confidence and knowledge of technology to utilize them for instruction, many teachers may feel intimidated and unwilling to explore the possibilities offered by them. With this in mind, this paper is going to present a brief discussion of the obstacles that teachers face as they try to adopt digital pedagogy in Kenya especially at this critical period of Corona virus pandemic.

A. STATEMENT OF THE PROBLEM

The use of online and digital pedagogy is particularly at a dynamic stage in Africa. A review of several studies shows that the integration of ICT in education is still at a limited stage. Through teaching experience, the author has noted that there is a notable inability of teachers to adopt digital pedagogy and those traditional methods were still prevailing in our institutions. This is mainly due to many obstacles which includes the lack of adequate teacher training, limited knowledge about the operation of digital devices and lack of the right digital gadgets, besides teachers' fear of abandoning traditional methods.

The teachers who are engaged to work in the primary, secondary and even tertiary institutions do not have enough experience to utilize modern methods and strategies in teaching and learning. In fact, they lack relevant teaching-learning activities, which have a significant impact on the learners' technical knowledge. In light of current requirements, it is essential that teachers become aware of such techniques and their method of utilization in order to create a generation of learners who are capable to cope up with rapid developments in digital literacy.

Through literature review of several studies, the author further noticed there was scarcity of studies relating to the development of digital pedagogy as an augmented reality. The available studies mainly focused only on the integration of ICT with the traditional methods. With this problem in mind, the author assumed that the government ought to enhance digital education so as to increase the level of academic achievement among the learners at all times. The purpose of this study therefore, focuses on digital pedagogy as an augmented reality; identifying the obstacles to and proposing the possible solutions that the government should adopt in order to overcome these obstacles to digital pedagogy.

B. OBJECTIVES

The aim of this study was propelled by the following objectives:
✓ To analyze the contemporary understanding of the term "digital pedagogy".
✓ To identify the Augmented-reality technologies that is available for digital pedagogy in Kenya.
✓ To identify the obstacles of facing digital pedagogy as a method of teaching in Kenya.

C. QUESTIONS

The on-going study raises the following questions:
✓ What is the contemporary understanding of the term "digital pedagogy"?
✓ What are the Augmented-reality technologies that are available for digital pedagogy in Kenya?
✓ What are the obstacles of facing digital pedagogy as a method of teaching in Kenya?

D. SIGNIFICANCE

The significance of the study underscores the following benefits:
✓ The results of the study will encourage teachers to be effective in the use of digital pedagogy which befits the contemporary learners who are digital natives of our time.
✓ Enhance the preparation of a generation of learners who are digital literate and are capable of dealing with the emerging issues in education sector.
✓ Impress on the government the need to support teachers who are ready to utilize the digital technologies in teaching and raising the level academic achievement among learners.

E. RESEARCH TOOLS

The following tools were adopted in the study:

✓ A questionnaire that identifies the availability of Augmented-reality technologies for digital pedagogy among teachers.
✓ A questionnaire that identifies obstacles of using Augmented-reality technologies in digital pedagogy.
✓ An observation check-list that was used to conduct inventory among teachers who were using digital pedagogy as their teaching method.

F. RESEARCH METHODOLOGY

The study adopted the descriptive method as it is appropriate for the subject of the study. These methods include date collection, categorization and explanation as well as reviewing previous studies and researches. This method is not only limited to describing the problem; it considers, analyzes and explains all aspects and reasons of the problem and proposes some solutions. Further, through the adoption of such method, the current situation of digital pedagogy in Kenya can be identified.

II. UNDERSTANDING DIGITAL PEDAGOGY

Digital pedagogy refers to design, development and use of contemporary technologies in teaching and learning. It has roots in the Piaget's theory of constructivism which maintains that cognitive development provides one of the building blocks of constructivist pedagogy (Terhart, 2003). Through this theory, learners are seen as intellectually generative individuals who have the capacity to pose questions, solve problems and construct theories and knowledge by themselves aided by the digital gadgets, also known as augmented reality.

As an Augmented-reality, digital pedagogy requires that schools use a diverse set of digital tools to communicate, create, disseminate, store, and manage information. In some contexts, digital technology has become integral to the teaching-learning interaction, through such approaches as replacing chalkboards with interactive digital whiteboards, using students' own smart-phones or other devices for learning during class time, and the flipped classroom model where students watch lectures at home on the television or computer and use classroom time for more interactive exercises.

In specific terms, digital pedagogy requires that teachers should embrace digital literacy in teaching-learning process. This approach can lead to higher order thinking skills, provide creative and individualized options for students to express their understandings, and leave students better prepared to deal with ongoing technological change in society and the general workplace.

Digital culture has changed the way people live, work, play, and learns; impacting the construction and distribution of knowledge and power around the world. Teachers who are less familiar with this digital culture are increasingly at a disadvantage in the national and global arena. Digital literacy, that is, the skills of searching for, discerning, and producing information, as well as the critical use of new media for full participation in society, has thus become a vital consideration for curriculum frameworks. In Kenya, digital literacy is being built through the policy formulation on incorporation of information and communication technology (ICT) into schools.

A. AUGMENTED-REALITY TECHNOLOGIES

The term Augmented Reality (AR) is used by researchers and developers to refer to a wide spectrum of technologies which integrate computer generated content, including text, video, 2D virtual images, and 3D virtual objects, into users' perceptions of the real world. Höllerer and Feiner (2004), defined Augmented Reality systems as those which combine "real and computer-generated information in a real environment, interactively and in real time, and [which align] virtual objects with physical ones" (p. 2). Early on, researchers tended to define AR in reference to specific facilitating devices, such as head mounted displays (HMDs). Today, the following devices are commonly used in education:

a. LAPTOPS

Less expensive laptops have been designed for use in schools, with features like lower power consumption, a low cost operating system, and special re-programming as well as mesh network functions. Despite her efforts to reduce costs, the government of Kenya initiated a program in 2016 of providing one laptop per child to all primary school pupils but the program has so far stalled (Daily Nation, 2019).

b. TABLETS

Tablets are small personal computers with a touch screen, allowing input without a keyboard or mouse. Inexpensive learning software (apps) can be downloaded onto tablets, making them a versatile tool for learning. The most effective apps develop higher order thinking skills and provide creative and individualized options for students to express their understandings.

c. INTERACTIVE WHITE BOARDS OR SMART BOARDS

Interactive white boards allow projected computer images to be displayed, manipulated, dragged, clicked, or copied. Simultaneously, handwritten notes can be taken on the board and saved for later use. Interactive white boards are associated with whole-class instruction rather than student-centred activities as required at the moment. Student engagement is generally higher when ICT is available for student use in and out of the classroom environment.

d. E-READERS

E-readers are electronic devices that can hold hundreds of books in digital form, and they are increasingly utilized in the delivery of reading material. Students, both skilled readers and reluctant readers, have had positive responses to the use of e-readers for independent reading. Features of e-readers that can contribute to positive use include their portability and long battery life, response to text, and the ability to define unknown

words. Additionally, many classic book titles are available for free in e-book form.

e. FLIPPED CLASSROOMS

The flipped classroom model, involving lecture and practice at home via computer-guided instruction and interactive learning activities in class, can allow for an expanded curriculum. There is little investigation on the student learning outcomes of flipped classrooms. Student perceptions about flipped classrooms are mixed, but generally positive, as they prefer the cooperative learning activities in class over lecture.

III. OBSTACLES TO DIGITAL PEDAGOGY

Obstacles refer to the barriers to change. Researchers have perennially classified obstacles into two main categories; the external and internal obstacles. The external obstacles are institutional and emanate from without the individual and they include factors such as technological difficulties, lack of enough time, inadequate technical support, and incomplete resources. Internal obstacles come from within the individual and relate to the educators' approaches to the use of digital technology such as resistance to change, lack of awareness and negative attitudes. Researchers such as Dogra & Thakur (2013) have attempted to identify the obstacles to the use of digital technology among teachers. From similar studies, it was found that obstacles are barriers and may be collected into several categories, for instance, resource-related obstacles, institutional-based obstacles, and attitudinal-based obstacles (Baleghi-Zadeh,et al. 2014). Discussant bellow is focused on the institutional-based obstacles.

A. LACK OF TEACHER PROFESSIONAL DEVELOPMENT

Teachers need specific professional development opportunities in order to increase their ability to use ICT for formative learning, assessments, individualized instruction, accessing online resources, and for fostering student interaction and collaboration. Such training in ICT should positively impact teachers' general attitudes towards ICT in the classroom, but it should also provide specific guidance on ICT teaching and learning within each discipline. Without this support, teachers tend to use ICT for skill-based applications, limiting student academic thinking. In order to support teachers as they change their teaching style, it is essential for education managers, supervisors, teacher educators, and decision makers to be trained in ICT use.

Trained and Uses ICT	f	%
Teaching	12	20
Research	14	23
Planning to teach	6	10
Individualized instruction	0	0
Interaction and Collaboration	6	10
Assessment	0	0
Record keeping	22	36
Total	**60**	**100**

Table 3.1: Teacher training on ICT use

The table above (table 3.1) indicates that the majority of the teachers 22 (36%) were trained and used ICT for record keeping, compared to 14 teachers (23%) who used computer to research. It is clear that the computer was not used by the majority of the teachers in schools for instruction. Schools did not provide students with opportunity to interact with modern technology. In fact, the digital gadgets are outlawed in both primary and secondary schools in Kenya. The data above show that institutions in Kenya do not incorporate the use of digital technology and they cannot seriously claim to prepare learners for life in the 21st century.

B. LACK OF PROPER ICT INVESTMENTS

In order to ensure the investments made in ICT benefit both teachers and students, additional conditions must be met. The government policy need to provide schools with the minimum acceptable infrastructure for ICT, including stable and affordable internet connectivity and security measures such as filters and site blockers. This policy need to target basic digital literacy skills, ICT use in pedagogical settings, and discipline-specific uses. A successful implementation of digital pedagogy requires proper integration of ICT in the curriculum. Although inaugural digital content has been prepared by Kenya Institute of Curriculum Development (KICD), a lot more need to be done in terms of content design and development. It is important also that digital content be developed in local languages in order to reflect local needs and culture of the learners. The on-going technical, human and organizational supports are required to ensure access and effective use of digital technology in education.

Types of ICT in schools	f	%
PC computers e.g. Desktops/Laptops	36	60
Mobile devices e.g. tablets/smart phones	30	50
Interactive/ Smart boards	0	00
Overhead projectors	11	18
Television	43	72
Others (Video cameras)	7	12

Table 3.2: ICT investments in schools

Table 3.2 shows that 43 out of the 60 teachers (72%) noted availability of operational television (TV) set in their respective schools. They believed that television in school was not meant for teaching but general entertainment. Interactive-white-boards are rare devices in our institutions and this implies that blackboards are still preferred teaching aid in our schools. The computers are available as a norm at 60% but are not fully utilized for pedagogy. Mobile devices such as tablets and smart phones were available at 50% but they were used by teachers for personal communication and not for teaching purposes. Overhead projectors were available at 18% and other available ICTs had a minimal percentage of 12%. Despite the availability of these ICT devices in schools and tertiary institutions, teachers felt that they were not competent enough hence; they could not embrace digital pedagogy leave alone meriting a title for the 21st century educators.

## C. RESOURCE CONSTRAINED CONTEXTS

The total cost of ICT ownership is considerable high for most institutions. Likewise, the training of teachers and administrators, connectivity, technical support, and software allocations, amongst other resources are very expensive. In order to bring ICT into classrooms, policies should use an incremental pathway, establishing infrastructure and bringing in sustainable and easily upgradable ICT resources. Some institutions in Kenya have begun to allow students to bring their own mobile technology such as laptops, tablets, and even smart-phones into class rather than providing such tools to all students. However, not all families can afford such devices let alone having service plan for their children. Institutions in Kenya must ensure that all students have equitable access to quality digital devices for learning.

D. DIGITAL DIVIDE

The digital divide refers to disparities caused by digital media and internet access both within and across countries, as well as the gap between people with and without the digital literacy and skills to utilize digital media and internet (Arouri, 2013). The digital divide both creates and reinforces socio-economic inequalities of the world's poorest people. International policies need to intentionally bridge this divide to bring digital media, internet and digital literacy to all students, not just those who are easiest to reach (Noris, 2001).

There are various reasons that contribute to the digital divide. These includes but not limited to;
✓ Lack of electricity: it is estimated that 25 percent of the population in Kenya especially in rural areas is living without electricity connectivity.
✓ Literacy: it is also estimated that more than 13 percent of the population in Kenya is still incapable of basic reading and writing.
✓ Gender: women in Kenya are less likely to be online compared to their male counterparts.
✓ Poverty: millions of people in Kenya live below the international poverty line (a dollar a day).
✓ Cost: affordability of the equipment in Kenya is very high just like the cost of broadband access.
✓ Local content: lack of locally appealing digital content hinders the usage.
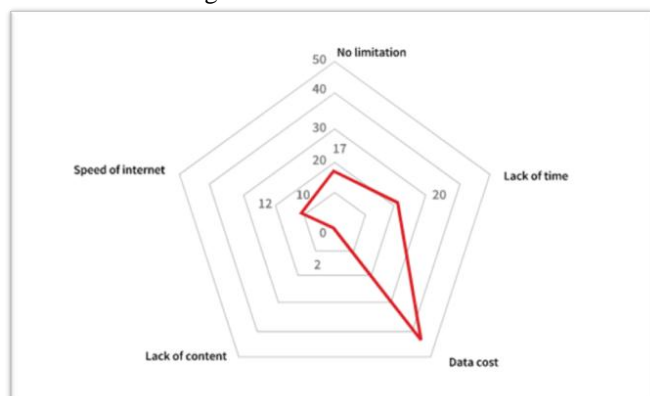
Source: RIA After Access ICT survey, 2017
Figure 1.1: Barriers to Internet use in Kenya

The figure above shows the barriers to internet access. The major barrier is considered to be the cost of data at 90 percent followed by lack of time at 45 percent. There are a majority of people with no limitations but were not interested with internet connectivity. Network coverage is another barrier to internet access. At least with 4G networks reaching less than 40 percent of population, only 29 percent in rural areas had access to internet of some kind by 2017.

E. MARGINAL AREAS AND MINORITY GROUPS

Students who live in the rural set up, especially those who live in the marginalized regions in Kenya are less likely to have digital devices such as computers, tablets, smart phones and internet connections at home. This situation is different for their colleagues who hail from the endowed urban areas. There are less educational resources available to the minority groups and their destined locality always put them at a disadvantaged situation compared to their majority peers who gather information from libraries, resource centres and digital sources. The availability of augmented-reality technologies within these marginalized areas can help improve the skills of minority students, especially in learning the common and core subjects of instruction, through features such as automated classroom activities, authentic audio-visual materials, and digital chat forums.

IV. SUMMARY OF KEY FINDINGS

Digital pedagogy in Kenya is wanting and teachers in both elementary and tertiary institutions must embrace the augmented reality in order to compete effectively in the 21st century world of technology. Educational planners in Kenya must consider improving the total cost-benefit of Educational Communication and Technology (ECT) equation in order to create affair working platform for all teachers and students. The government of Kenya must consider supplying and maintaining the requisite infrastructure necessary for digital pedagogy, and ensure that institutional investments are matched with teacher support. The ministry of education in Kenya should formulate robust policies aimed at effective implementation of digital pedagogy as an augmented reality to recon in the 21st century teaching and learning process. The government should urgently address the obstacles facing digital pedagogy in order to effectively achieve its aspirations as contained in the "Kenya Vision 2030" and the Jubilee manifesto of "Digtal Literacy".

In summary, this paper identifies the following key findings:
✓ There is a great need for teacher capacity building through training;
✓ There is a need for development of relevant digital content;
✓ There is a need for deployment of ICT infrastructure and
✓ Robust policy relating to digital literacy.

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