

# Impact of Mobile Technology in Transforming Education and Health Sectors of Nigeria: Strength and Challenges

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**Abstract - Mobile technologies continue to offer unprecedented opportunities for economic growth in both developing and developed countries. Mobile devices such as smart phones and tablets enable innovation and help students, teachers, and parents gain access to digital content and personalised assessment vital for a post-industrial world. Mobile technologies transform healthcare by improved chronic disease management, empowering the elderly and expectant mothers to have access to emergency services with a touch of a button. Therefore, this paper examined how mobile technologies serve as a strategic enabler in the transformation of education and health sectors. The challenges facing the implementation of mobile technology in both sectors and ways to overcome these hurdles are also discussed. Recommendations are suggested for future action on the deployment of mobile technology in both education and health sectors in Nigeria.**

**Index Terms** – Smart Phone, Tablets, Students, Transformation and Patient

## I. INTRODUCTION

Mobile technologies catalyse economic transformation and growth of Nigeria by enabling greater interaction and bringing a wide variety of services to the majority of the country's population. Mobile services have wider economic impact, since they enable different ways of conducting business, reducing the time and cost of transactions, improving access to markets, commoditizing information and generally allowing businesses to operate more efficiently [1].

Mobile technology and connectivity promote significant benefits to education globally. Most significantly, mobile services facilitate rapid communication between teachers, students and parents. Across all levels and age groups, mobile phones enable instant access and sharing of time-critical information between teachers and parents, ultimately benefiting students. Nowadays, mobile connectivity changes the way education is conducted in both developed and

developing countries. Many students in distance learning programs and online universities access educational

information and programs from the comfort of their home through the mobile broadband access [2].

Mobile technology enormously transforms the health sector in different ways. The emergence of new and innovative applications improves the way healthcare is being administered and managed in both developed and developing countries. Mobile technology is used to remind patients with chronic illnesses to take their drugs or make appointments for check-ups, saved many lives in countries where infant and maternal mortality becomes severe problems by delivering advice via SMS to pregnant mothers and health information to nurses and community health workers. In remote rural areas of developing countries, mobile technology allows doctors to reach more patients. Result from the pilot projects in India shows that, using remote diagnostics and telemedicine, doctors can reach twice as many rural patients as they could through face-to-face consultations [3].

Results from the Pyramid Research's survey of mobile users carried out in Nigeria in 2009 shows that 20% of respondents use their mobile phones for health related needs [1]. Within the group that uses mobile technology for health services, the most common activity is to make calls in emergency situations by either reaching out to friends or family or by calling emergency services. A small percentage of respondents indicated that they receive health monitoring assistance or public health alerts on their mobile phones, suggesting there is room for further information services related to health.

Therefore, this paper examined ways through which the mobile technologies have transformed education and health sectors in developed country. The challenges facing the deployment of mobile technologies and how to alleviate them are also discussed. Recommendations are suggested for future action on the deployment of mobile technology in both education and health sectors in Nigeria.

## II. USABILITY PROBLEMS ASSOCIATED WITH MOBILE DEVICES

Every technology has some limitations and weaknesses, and mobile devices are no exception because of some usability problems. [4] summarized these problems as follows:

- 1) Physical attributes of mobile devices, such as small screen size, heavy weight, inadequate memory, and short battery life;
- 2) Content and software application limitations, including a lack of built-in functions, the difficulty of adding applications, challenges in learning how to work with a mobile device, and differences between applications and circumstances of use;
- 3) Network speed and reliability;
- 4) Physical environment issues such as problems with using the device outdoors, excessive screen brightness, concerns about personal security, possible radiation exposure from devices using radio frequencies, the need for rain covers in rainy or humid conditions, and so on.

## III. WAYS THROUGH WHICH MOBILE TECHNOLOGY TRANSFORMS EDUCATION

Mobile technologies become more powerful, portable and convenient to accompany users anytime anywhere in the daily life, resulting in that the applications can facilitate users not only studying learning contents conveniently but also interacting with others collaboratively anytime and anywhere [5].

Mobile devices enable learning to take place at any time, in any location, and at a learner's pace. [6] describe five properties of mobile handheld devices that produce unique educational affordances: portability, social interactivity, context sensitivity, connectivity, and individuality.

The usage of mobile tablets in the learning environment yields many benefits for students in terms of improving their motivation, collaboration, creativity and developing IT skills [7]. On the other hand, teachers can also benefit from the technology in different forms such as classroom management and organization, student evaluation, visual quality of teaching materials and finding a unique teaching approach with the use of mobile tablets in classrooms.

### *Educational Benefits of Mobile Technologies Usage*

Educational benefits that could be created through judicious use of mobile technologies according to [8], [9] & [10] are:

- 1) Deliver multimedia materials designed specifically for mobile devices

- 2) Allow students to browse what is available in the online environment
- 3) Continuous and situated learning support
- 4) Decrease in training costs
- 5) Improving levels of literacy, numeracy and participation in education amongst young adults.
- 6) Great for just-in-time training or review of content.
- 7) Support differentiation of student learning needs and personalized learning.
- 8) Can enhance interaction between and among students, learners and instructors.

### *Challenges Hindering the Effective Application of Mobile Technologies in Education*

However, the challenges hindering the effective application of mobile technologies in education are:

- 1) *Contextualised content*: Since, social divide exists between people living in rural and urban areas and also different cultures and languages vary from region to region therefore, mobile learning activities need to take into account the learning abilities in different regional areas across the nation [11]. Hence, special attention is needed in producing suitable content for different contexts and provides learning content that is suitable for different regions, different social and cultural backgrounds, and different levels of literacy.

- 2) *Usability*: The usability of mobile technology can be a factor in the success of educational activities. Battery life, screen brightness and button defects have had negative impact on the usability of mobile device in education [12]. Also, the user interface in the mobile devices affords a somewhat passive style of interaction whereby students watch and then click next. To design and implement the content that will actively engage students to enable the usability is very difficult to accomplish.

- 3) *Teacher support*: Teachers do not have tablets in some schools, which cause severe problems for class preparation. Obviously, many teachers use the tablets as an alternative to teaching (e.g. one period per day the children undertake tablet activities) rather than as a complement to traditional classroom activities. Clearly, there is need to support the teacher in the classroom environment so as to enable blended learning experiences.

- 4) *Learning outcomes*: It is necessary for the teacher to monitor how students are using the tablets to achieve the learning objectives set out in the curricula. Therefore, a lesson plan that link the curriculum to specific tablet activities should be designed and this will enable the teacher to incorporate the use of tablets into their existing classes.

#### IV. WAYS THROUGH WHICH MOBILE TECHNOLOGY TRANSFORMS HEALTH

Mobile technology has proven to be a transformational tool in health sector. The emergence of new and innovative applications improves the way healthcare being administered and managed. Mobile health has become an indispensable part of this hyper-connected world, where physicians and patients alike are prolific mobile adopters [13].

One of the biggest components within mobile health is app. Mobile health apps can be broken into two categories: wellness and medical; 85% of apps are for wellness, designed to be used primarily by the consumer and patient, and the remaining 15% are medical, used by physicians [13]. Consumer wellness apps fall into a few sub-categories: physical fitness or training, self-measurement (e.g. pregnancy trackers), health information (predominantly nutrition based), and self-testing (including calorie monitoring or sensor triggering to monitor things such as heart rate). Physicians are using apps as an equipment supplement, and advances in mobile sensors are helping them identify potential health problems [13].

##### *Benefits of Mobile Technologies to Health Sector*

The benefits of mobile technologies to health sector include [3] & [14]:

1) Mobile technologies provide access to emergency services and increases awareness about the treatment and prevention of rapidly spreading diseases, such as HIV, Ebola, etc.

2) Mobile technologies provide sensor alert system that improves aging populations' safety. These sensor alert systems are connected to home to monitor patients' vital signs which allow those suffering from diseases such as COPD to rehabilitate at home and sending individuals reminders to take their medications on time.

3) Mobile technologies connect many communities to emergency and first-response services which help to overcome the choke points and disruptions that fixed networks experience in disaster areas.

4) Mobile technologies help to monitor the spread of pandemics and viruses and provide an advance warning system and the necessary data for early preventive action.

5) Mobile technologies increase both the efficiency and reach of healthcare services by maximizing healthcare professionals' time while also reducing costs of maintaining the delivery of quality healthcare along the value chain.

6) Mobile technologies help patients to take more responsibility for their own health, easing the pressure on

healthcare workers and allowing a greater number of interventions to be made using technology.

7) Mobile technologies enhance medical compliance management because they can be used to remind patients with chronic illness to take their drugs or make appointments for check-ups.

8) Mobile technologies allow doctors to reach more patients in remote rural areas. Both remote diagnostics and telemedicine enable doctors to reach twice as many rural patients as they could through face-to-face consultations.

9) Mobile technologies allow patients and community workers to communicate with hospitals or healthcare centres via text or phone, maximize the time of specialist in attending to patients and reducing trips to the hospital for patients with long term illnesses.

##### *Challenges Hindering the Effective use of Mobile Technologies in Healthcare*

The challenges hindering the effective use of mobile technologies in healthcare [15]:

1) *Physical connectivity issues:* The physical construction of healthcare facilities and difficulties in accessing broadband networks pose problem to integration of mobile technologies in health sector. Connectivity challenges may arise due to coverage gaps in wireless systems and mountainous or other unfavourable terrain that limits coverage. To overcome this barrier, there should be installation of universal repeaters, survival remote gateways and distributed antenna system. This issue can also be resolved by purchasing a mobile virtual private network software solution. This kind of software maintains the stability of applications even when there is little or no wireless coverage, without the need to install extra repeaters or other hardware.

2) *Technology connectivity issues:* The limitless in the bandwidth available on the network could limit clinician access to patient information especially when large files, such as PACs images or video are viewed over wireless connection. This can be averted if clinicians maintain access to appropriate patient information by segmenting their network. They limit the bandwidth of their guest network to minimize the impact of large downloads, such as streaming video. Another approach is to use management and policy software which enables IT administrators to centrally control, prioritize, and manage which applications and devices have access to the



network. In addition, this software provides compression and optimization techniques which enable high-bandwidth applications to be utilized more efficiently over wireless networks.

3) *Meeting user demand:* Users expect the same performance and reliability they enjoyed on conventional system to be adequately available in mobile technology without care about the technical side. A key concern is that the mobile technology fulfils its promise to improve productivity, without requiring the end users to become “IT experts.” Managing the expectations of clinicians is not always easy. Several IT professionals indicated that physicians trying to access patient clinical information via a wireless network have gone out and purchased technology, such as cellular phones or wireless access points, without first identifying whether the IT department can support that technology. Then when the technology doesn't perform up to expectations, the IT department is asked to rectify the situation, when this isn't always possible. The solution to address this is to put a policy in place surrounding which devices will be supported by the IT department.

4) *Security considerations:* To manage the security of the data being accessed by the systems and the expectations of the clinicians using the systems also pose problem to mobile technology deployment in healthcare. One way to safeguard information is to provide a secure means of accessing data. Some organizations require security protocols, such as single sign-on, to secure patient data. However, this can create challenges for IT professionals and the additional security can also be frustrating for clinicians. Many organizations use a virtual private network (VPN) through which clinicians and other care providers, such as first responders, can access patient information. Another security consideration is that clinicians are providing guest access to their networks for patients and their families. Many organizations are solving this issue by segmenting their network to accommodate different types of access, which provides an additional level of security for patient data.

5) *Integration with existing IT systems:* With the development and the use of mobile health, healthcare organizations need to ensure that these mobile apps and technologies are integrated with existing health IT systems and standards. For that to happen, latest mobile health technologies need to be properly researched and all loop holes during integration need to be addressed.

## CONCLUSION

In recent years, interest towards the use of mobile technologies in education and health sectors are increasing in both developed and developing countries. Today, a wide range of new digital content is available to both the students and teachers, such as instructional games, augmented reality, interactive websites, and personalized instruction. The virtue of electronic information is that it gives students greater control over their curriculum, thereby allowing students to proceed at their own pace and in their own learning styles [14].

This digital revolution enables real-time assessment of students' performance. Hence, students no longer wait for weeks to receive feedback regarding their skill mastery, because, teachers can now embed pop-up quizzes in online content delivery and pupils can be evaluated on an on-going basis. This provides regular, real-time feedback to students and parents and allows teachers to see which students need extra help and which ones need more challenging assignments [16].

Though, using mobile technologies in education pose many challenges but indications from students, teachers, administrators and parents are excited on the fact that the effective leverage of these devices and tools in education increases student achievement, teacher productivity and home support of learning.

In recent times, both developed and developing countries are unable to provide adequate health care because of the problems such as physical distance between doctors and patients, too few skilled health care professionals and the extraordinary complexity between insular medical systems and costs of health care equipment and infrastructure. In addition, the current epidemic of chronic illnesses, in both developed and developing economies call for the need of innovative, efficient, technology-supported interventions [16].

Mobile technologies offer the ability to connect patients with their doctors, care-givers and loved ones and enable timely health monitoring which suggests improved patient engagement and better health outcomes. Mobile technology can aid in providing access to information, helping to lower costs, facilitating remote care and increasing efficiencies by connecting patients to their providers virtually anywhere. Mobile health applications and services are becoming an essential tool in extending health care resources around the world.

## RECOMMENDATIONS

Basically, there are two critical components to enable mobile learning reach its full potential (i.e. universal availability of mobile devices and universal availability of cellular connectivity for these devices) [17].

Mobile technologies offer help with healthcare access, affordability and service delivery. Through mobile applications, sensors, remote monitoring devices, and

reference materials, health care delivery can be improved.

#### *Suggested Recommendations for Future Deployment of Mobile Technologies in Education*

Therefore, the following recommendations are suggested for future action on the deployment of mobile technologies in education [17]:

1) Building of faster mobile networks that will enable both the students and teachers to access content and take advantage of multi-media resources that are coming online.

2) Provision of high-speed wireless area networks to retrieve heavy multimedia educational resources that are available online because Wifi alone can't support the bandwidth requirements of heavy multimedia.

3) Ensure that all students, regardless of economic background, have access to mobile devices. If some individuals lack access to mobile hardware and software, it robs them of the educational opportunities that are available to their classmates.

4) Provision of adequate infrastructure, hardware, and training that helps the school to overcome some obstacles such as Internet connectivity problems, slow speeds, tablet management issues, JAVA challenges, finding free apps that work, and lack of keyboards and peripherals affecting the usage of tablets in school.

5) Provision of adequate awareness for teachers by training them to be aware that technology enhances educational attainment and teacher performance. Unless they believe technology improves instruction, teachers are not likely to adopt the new approach and deploy it in ways that will be effective.

#### *Suggested Recommendations for Future Deployment of Mobile Technologies in Healthcare*

The following recommendations are suggested for future action on the deployment of mobile technologies in healthcare services [16]:

1) Policy-makers should encourage the use of mobile devices that monitor patient symptoms and provide real-time advice on treatment and medication.

2) Ensure that there is widely availability of mobile applications that aids chronic disease management, sensors and remote devices that monitor patient physiology and electronic libraries that bring the latest knowledge to health providers around the globe.

3) Provision of software that helps health providers to understand how to deal with particular symptoms and drug interactions they should avoid. Also, accurate data on how to treat various ailments should be put in place.

4) Formulation of policy on how mobile applications and regulated mobile medical devices are to be treated so as to clarify some of the ambiguities and help further innovation.

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