USING MOBILE PHONES TO ENHANCE TEACHING AND LEARNING IN DEVELOPING COUNTRIES

Engr. Davidson Akporume

Abstract
The evolution of mobile phones have provided a vast and ubiquitous pool of information that can be harnessed for teaching and learning. The unprecedented amount of information and unlimited access to it has grown exponentially, thereby the potential for using diverse resources for instruction and learning have multiplied. Simply put, “Can mobile phones be used as an engaging tool to arouse student’s interest to learn?” If educational technology research, theory and pedagogy are re-evaluated to include the tools and knowledge students already possess, then will the use of mobile phones broaden student’s horizon and provide them with better opportunities to connect learning in their environment? These questions provide an insight into this study undertaken by the researcher on the impact of mobile phones on learning, perception of mobile phones for educational purposes, and pattern of the current mobile phone usage for education in Nigeria and other developing countries. It goes further to formulate methodical approaches on how to respond to the challenges of particular educational contexts, supplement and enrich formal schooling and make learning more accessible, equitable, personalized and flexible for students everywhere.

The use of mobile phones and other handheld devices to obtain or provide educational contents for teaching and learning is referred to as mobile learning. Educational contents are digital learning assets/resources available on these devices. Digital learning resources consist of learning materials (including textbooks, educational online videos and mobile apps, teaching games, e-worksheets, online tests, study objects), which are published in digital format (e.g. on the Internet, in databases or digital data media) (Lifelong Learning Strategy 2020).

Mobile learning is broadly defined as the delivery of learning content to learners utilizing mobile computing devices (Parsons & Ryu, 2006). Most researchers and educators probably view mobile learning as the immediate descendant of e-learning. Quinn(2000) defined mobile learning as simply learning that takes place with the help of mobile devices, or the intersection of mobile computing (the application of small, portable, and wireless computing and communication devices). In line with this definition, several authors (Pehkonen & Turunen, 2003) view mobile devices as a pervasive medium that may assist us in combining work, study and leisure time in meaningful ways. Given the ubiquity and rapidly expanding functionality of mobile technologies, mobile phones have the potential to improve and facilitate learning, particularly in communities where scarcity of educational opportunities exists. Aided by affordability of cheap smartphones and availability of 3G and 4G networks, the growth of mobile phone users in developing countries have reached a threshold. The possibility of timeless connectivity makes mobile phones a viable and feasible personal technology for distant learning. This is made possible by the recent trend in mobile phone penetration in developing countries, which will guaranty ownership of these devices by every student in the nearest future. This is sufficient reason to make mobile phones an essential tool for teaching and learning in developing countries. If educational theory, research and pedagogy are re-evaluated to include tools and knowledge students already possess, then it is pertinent to have a lucid understanding not only of technology but also of students who will be using these devices and teachers who will be implementing their usage in delivering qualitative education.

An estimated 774 million people cannot read or write worldwide, and illiteracy can often be traced to the lack of books. Now mobile phones can cheaply and conveniently put electronic books (ebooks) in the hands of users across developing countries (Rayman, 2014)
International Telecommunication Union (ITU) World Telecommunication / Information Communications Technology (ICT) Indicators database estimate that mobile phone penetration will reach 90% in developing countries by the end of 2014 (ITU World Telecommunication, 2014).

Bloom’s Taxonomy

Bloom’s taxonomy is an education model for defining competency in mastering learning. This is categorized into; Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation

1. At Knowledge Level of learning a student can define terms
2. At Comprehension Level of learning a student can work assigned problems and can give examples of what they did.
3. At Application Level of learning a student recognizes what methods to use and the use of the method to solve problems.
4. At Analysis Level of learning a student can explain why the solution of processes works.
5. At Synthesis Level of learning a student can combine the part of a process in new and meaningful ways.
6. At Evaluation Level of learning a student can create a variety of ways to solve problem and then based on established criteria, select the solution best suited for the problem.

Integrating this model in mobile learning using the bloom’s application involves using several software in mobile devices for teaching and learning that depicts Bloom’s taxonomy paradigm.
Fig.1: Bloom’s Taxonomy Wheel for Mobile Learning

Taxonomy wheel was first discovered on Paul Hopkin’s educational consultancy website mmiweb.org.uk. The wheel was produced by Sharon Artley and was an adoption of Kathwohl and Anderson’s (2001) adaption of Bloom (1956). The idea to further adapt it for the pedagogy possibilities with mobile devices
Fig. 2: Correlation of Bloom’s taxonomy with mobile learning application (https://sites.google.com/a/aps.edu/aps-ipad-apps/bloom-s-taxonomy-m-learning)
Fig. 3: Bloom’s Taxonomy and its integration into the Digital technology for mobile learning (http://www.educatorstechnology.com/2014/04/wonderful-visual-featuring-three.html)

**Application of the Elements of Bloom’s Taxonomy to mobile learning**

**Creating:** This involves using mobile applications that help to design, change, produce, invent, transform and find unusual ways of simplifying teaching and learning. Examples are: 
- **CreativeBookBuilder** for making iBook or ePUB mobile readers;
- **iMove** software for animations, video editing, storytelling, presentations, etc. Interview assistant provide features on mobile devices that allow users to take audio and text notes during interviews.
- **Wordpress** helps in note taking;
- **TimeLapse** applications helps in creating stunning time lapse and stopping motion videos straight from mobile devices. Other creative applications include; **Voicethread**, **ScreenChomp** for recording touchscreen interactions and audio so that users can share their thoughts (it provides a whiteboard like a canvass to jot down and share ideas).

**Evaluating:** Mobile applications that allow users to post, rank, evaluate, moderate, select, appraise, judge and verify ideas include: **WEB to PDF** for converting web files to PDF formats for the ease of readability on mobile devices; **ShareBoard** for sharing music, videos, documents and photos of any size instantly with friends; **Prompsters** for public speaking afford users smooth tele-prompts and easy readability for audible presentations (ideal for practicing and delivering public speeches, lectures and sermons), **Notability software** like **WizNote**, **Notezilla**, **Evernote**, **Fetchnotes**, etc for capturing and organizing notes and ideas; **StudentPad** for reading books and taking notes, writing, drawing, managing classroom related documents and information and doing mathematics; **WikiNods** for web searching using Wikipedia on mobile devices, etc.

**Analysing:** Mobile applications that allow users to outline, differentiate, survey, examine, distinguish, and classify ideas are: **iCardsort** for mind mapping (for quick and easy ways of processing and organizing ideas); **SurveyPro** for collecting data by surveyors; **Mindmash** for creating ideas in form...
of text, images and basic shapes as visual aid for brainstorming. Other software include: ComicLife, inspirationmaps, Dropvox, Bento, etc

**Applying**: Editing, implementing, operating, constructing, interviewing, teaching, making puzzles can be done with mobile applications like: **ExplainEverything** software which is a unique interactive whiteboard screencasting tool used by over 1.8 million students and educators; **GoogleDoc** for creating, viewing and editing documents, spreadsheets and presentations, **EverNote** allow users create, edit, organize and share notes in work chats.

**Understand and Remember**: Mobile software used to recognise, describe, name, infer, explain, interpret, summarize and exemplify are: **iAnnotate** for reading, marking up and sharing PDF documents; **CourseNote** for note-taking by handwriting on the screen of mobile devices; **RSS Feed Reader** for following blogs and sharing information with friend. Other applications are **Quizcast**, **Blog Docs**, **Google Search**, etc

**Response to Technology by Teachers in Developing Countries**

Due to the proliferation among teachers for personal use, mobile phones hold greater potential than PCs or laptop computers for educational use by significantly large numbers of teachers in developing countries including those in remote, socio-economically deprived areas.

Mafenya (2011) opined that most users do not consider the mobile phone’s potential for education. The reality is that many teachers are unaware of the educational potential of mobile phones, especially when the evidence to support mobile learning is sparse. The impact of the integration of technology into teaching and teacher development range from technophobia at one extreme to enthusiasm and innovation at the other.

A case study is the evaluation of the use of personal laptops and the integrated XO laptops developed by the One Laptop per Child (OLPC) programme among learners in a semi-rural primary school in Rwanda. Lack of exposure and the fact that the language options for the operating systems and applications did not include their native language intimidated teachers (Ernst and Young, 2010). This finding is consistent with report by Agbatogun (2010) and Fanni, Rega, Van, Tardini, and Cantoni (2010) that the lack of computer training could lead to cyberphobia and limit the use of computers for the adoption and use of Information and Communication Technologies (ICTs) by teachers for their own professional development.

On the other hand, developing countries have a measurable amount of teachers who make innovative use of technology to support teaching and learning. Annually, teachers from these countries are recognised by The Annual Partners in Learning Innovative Teachers Awards in Africa and the Middle East, hosted by SchoolNet South Africa and Microsoft, for their innovative use of technologies to support high-quality learning experiences. UNESCO, (2012)
Fig. 4: UNESCO Representation of Benefits Mobile Phone as an Educational Resource
A UNESCO study has reported a revolution in reading habits in developing countries, where books can be scarce but mobile phones are not. The UN estimate that some 6 billion people have mobile phones – more than the amount of people who have access to toilet – and technology that compresses data can help mobile phone users with even basic phones cheaply access educational materials. (United Nations, 2013)

A well respected study of 16 Sub-Saharan African countries found that most primary schools have few or no books, and in many countries these low levels are not improving (Ross, 2010). This considerably slows the reading acquisition process and consequently affects learning in all other school subjects.

Professor Emmanuel Nolue Emenanjo, a Nigerian scholar and writer compared the library per population ratios of several countries and found, perhaps unsurprisingly, that higher ratios correspond to higher levels of illiteracy. In Japan, where 99 per cent of people can read and write, there is 1 library for every 47,000 people; in Nigeria, by contrast, the ratio is 1 library to 71,350,000 people (Ajeluorou, 2013).

Emenanjo estimates that Nigeria currently meets less than 1 per cent of its book needs, contributing to an illiteracy rate of over 40 per cent (UNESCO, 2014). His calculation is based on a modest definition of book needs, which assumes every primary-school student should have four to six books and every secondary school and tertiary school student eight books.

**Promotion of Learning with Mobile Phone**

Sharples (2003) suggests that rather than seeing mobile phones as disruptive devices, educators should seek to exploit the potential of the technologies learners bring with them and find ways to put them into good use for the benefit of learning practice. Apart from increasing the access to educational services, the use of mobile phones can influence learning modalities that in turn, impact outcome of qualitative education delivery. (Rashid & Elder, 2010)

In this regard, mobile learning represents more than a mere extension of traditional form of education, it facilitates alternative learning approach and instructional methods that the theories of new learning identify as effective learning practice.

According to proponents of new learning, mobiles facilitate designs for personalized learning in that they are responsive to different and diverse ways learning occurs. They facilitate designs for situated learning by providing learning during the course of the activity – in the field for a botany student, in the classroom for a teacher trainee, or in the workshop for an engineer. In this sense, mobile learning also facilitates designs for authentic learning, meaning learning that targets real-world problems and involves projects of relevance and interest to the learner (Kukulska-Hulme & Traxler, 2007)

The supposed value of mobiles also arises from the manner in which they facilitate lifelong learning. Mobiles can support the great amount of learning that occurs during the many activities of everyday life, learning that occurs spontaneously in impromptu settings outside of the classroom and outside of the usual environment of home and office. They enable learning that occurs across time and place as learners apply what they learn in one environment to developments in another (Sharples, Taylor & Vavoula, 2005).

Mobile phones theoretically make learner-centred learning possible by enabling students to customize the transfer of and access to information in order to build on their skills and knowledge and to meet their own educational goals (Sharples, Taylor & Vavoula, 2007). Mobile learning thus exerts a democratizing effect on the learning experience as learners take a greater responsibility for the learning process instead of being passively fed information by an instructor. Whereas in traditional models of education the goal is the transfer of knowledge from
teacher to student, mobile learning empowers students to actively participate in the learning process to make it a process of construction and not mere instruction (DelaPena-Bandalaria, 2007).

Mobile learning thus represents learning that is not ‘just-in-case,’ education for the sake of producing a bank of knowledge, but rather represents learning that is ‘just-in-time,’ ‘just enough,’ or ‘just-for-me’ (Traxler, 2007:5).

As a facilitator of new learning, mobile learning goes beyond an emphasis on the possession of information to enabling learners to find, identify, manipulate, and evaluate existing information (Brown, 2003:2).

Mobile phones can facilitate knowledge-centred learning by providing efficient and inventive methods of deepening student’s knowledge of specific subject matter rather than memorizing large amounts of information – and then using this knowledge for learning through integration and interconnection.

Assessment-centred learning and the provision of continual feedback throughout the learning process is made possible with mobile phones. Learners are provided with diagnosis and formative guidance of what can be improved and what might be learned next. Moreover, in providing prompt feedback, mobile learning maintains the appeal of learning and provides a motivating factor that can at times be lacking in traditional modes of education (Geddes, 2004)

Community-centred learning is facilitated through the use of mobile phones, because it is learning that the learner deems valuable due to its relevance to the surrounding social-context.

Mobile Reading Habits in Developing Countries

A report by UNESCO examined mobile reading habits in seven countries: Ethiopia, Ghana, India, Nigeria, Pakistan, Uganda and Zimbabwe and it was discovered that hundreds of thousands of people are using their mobile devices as a way to access full-length books and other reading materials (Smith, 2014).

The above survey carried out on 5,000 people showed that convenience is the main reason respondents used their phones for reading. “Mobile reading is popular for reasons that transcend political and cultural boundaries… people appear to like mobile reading because their device is always there.”

Accessibility of a wide variety of mobile books in areas which do not have libraries or print contents and affordability of mobile books compared to paper books were also cited by respondents. While most respondents already liked reading, majority of participants said they enjoyed reading more after they were exposed to mobile reading.

In New Guinea, mobiles are used to impact children’s reading comprehension via SMS messages. Experiments conducted in two similar elementary schools show that children who were given learning plan and read stories in English SMS messages had significantly more improved reading than those who were not read mobile stories. Daily messages sent to teachers improved the students’ fluency and ability to decode English words.
The survey also asked respondents about their initial attitude towards mobile reading when they first tried it and the results were overwhelmingly positive across all usage levels. While it was interesting to find that mobile reading amplified pre-existing positive attitudes towards reading, it was even more noteworthy to discover that mobile reading changed people’s negative attitude towards reading.

**Potential Barriers to Mobile Learning in Developing Countries**

Roschelle (2003) postulates that mobile devices may become increasingly compelling choice of technology for classrooms because they enable a transition from the occasional, supplemental use associated with computer labs, to frequent and integral use of computational technology.

An essential pedagogical aspect of mobile devices is that they extend the learning environment beyond the classroom, as they are portable, support the paperless classroom, and provide additional methods of communication (Juniu, 2003)

The implementation of mobile learning technology in developing countries have also been met with some resistance, obstacles and criticism, despite its ability to foster development and deliver qualitative education. Technophobia, funding, electric power, Internet connectivity and bandwidth, quality teacher training, sustainability of implementation are some of the barriers plaguing mobile learning.

Technophobia which means constant and persistent fear of technology has impeded the utilization of mobile phones for teaching and learning in developing countries. This fear is often culturally or religiously induced on teachers and learners alike. Electricity is vital to run mobile technology worldwide and until electric power is widely available, reliable and affordable for those in developing countries, the pace of educational technology assimilation is likely to be slow. Even if most people cannot afford mobile devices, electricity is necessary for a conducive learning environment.
**Using Mobile Phones to Enhance Teaching and Learning in Developing Countries**

Due to the installation of marine telecommunication cables, the potential to expand internet connectivity has increased substantially. Countries that are land-locked such as Chad and those that offer limited business demand for internet services, like Eritrea and Sierra Leone, will experience difficulties connected with increasing internet access and bandwidth in the near future.

Internet bandwidth, electrical devices, electrical power may all be at the disposal of teachers, but the technical know-how may be deficient or even non-existent. Teachers brought up in a world where technology is absent, will have difficulties using technology to engage and support learning. Training provided to teachers for professional development must be sufficient and long enough for them to grasp the concept behind teaching with technology, in order to have hands-on experience using the technology to develop pedagogy in their classrooms or online environments.

There is so much emphasis on the need to foster quality learning environment by government bodies or funding agencies in developing countries, but funding minimal training for a large number of people within a short duration of time is an ineffective approach to mobile learning. Premium is on quantity not quality.

Novel instructional technological methods of teaching and learning that cannot be sustained becomes a liability to the user because of frustration. The outcome of educational technology projects in developing countries do not focus on subsequent improvement and sustainability, once the initial funding ends. Educational professionals get excited by the latest trends- the use of smartphones, because they are appealing. Once this glitzy technology (smart phones) is not maintained, it becomes a sophisticated paper weight.

**Conclusions**

Today’s mobile phones have a multiplicity of functionalities like camera, audio/video recorder, mp3/video player, internet connectivity, GPS devices, eBook readers, game console, barcode, Quick Response code Scanner, motor sensor, SMS/Short Message Service), etc. The goal of mobile learning is to harness these functionalities for the development and delivery of qualitative education in the twenty-first-century context.

Teachers and learners are exploring innovative ways of incorporating the use of phones to change the status quo created by the traditional mode of learning and teaching in developed countries. Mobile learning in most developing countries is still at the rudimentary or perhaps at the research and development phase of implementation.

Games in mobile devices is now used to stir learner’s interest in education and cultivate intuitive learning skills. Games which have been a pervasion to the upcoming generation, is now used to the advantage of learners.

Collaboration among educators, learners and parents is now possible with Bluetooth connectivity, short messaging, infrared which enable group work and sharing of assignments. Automated assessment of learners as a way of measuring their performance in learning and improvement of feedback among learners, teachers and parents is made possible. Rectification of lapses in learning and encouragement of better performance by students can be done.

Despite the aforementioned benefits of mobile phones for enhancing learning in developing countries, there are some setbacks bedevilling this development. These are:

(i) Technical challenges on sustaining and maintaining this technology
(ii) insecurity from the usage of wireless internet which might lead learners to join negatives groups that can threaten their safety
(iii) troubleshooting support services for mobile technology
(iv) training and issues on instruction
(v) acceptability of technology by learners and teachers due to technophobia/cyberphobia
Recommendations

In order to deliver qualitative education in developing countries that is compatible with what is available in the developed countries, there is an expedient need to put infrastructural and human resources in place to meet this goal with mobile learning.

Partnership with telecommunication industries for technical support in mobile learning is ongoing, but the cost of this services outweighs the benefits. Its affordability by learners in developing countries is in question because of its prohibitive cost. Government and funding agencies in the ministry of education should partner with these telecommunication industries to help reduce this cost of disseminating mobile learning infrastructure such as wireless connectivity and 3G network.

Training and retraining of teachers on the use of this technology should be done consistently because of the changes in the software used for this technology. This training will enable teachers in developing countries to catch-up with radical changes resulting from software updates in order to meet new trends in qualitative pedagogical development.

Without knowledge and control of how to use mobile devices for learning, abuse is inevitable. Students using mobile learning facilities should be properly supervised, so that they do not thwart the objective of this technological innovation by using it for other purposes like chatting with friends on facebook, viewing materials that are of no educational benefit to them online, watching obscene movies and so on.

Government should endeavour to provide electricity and other backup sources of power like generators, inverters, UPS (Uninterruptible Power Supplies) for keeping mobile learning facilities in continuous working conditions. Government should also provide conducive learning environment for this technology to thrive.

There should be awareness of the benefit of this technology for teaching and learning to avoid technophobia and gender disparity amongst people.
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