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Multimedia Mobile Learning in Nigeria: Future trends and Implications for Sustainable Development

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Abstract
The complexity of today's global society and the accelerating rate of change require that students learns, computes, thinks, creates, and innovates continuously. That translates into a critical need to become extremely efficient in the use of multimedia mobile learning. Recent innovations and emerging trends in education have mostly centred on the creation of multimedia learning content, largely in the form of text, graphics, videos, narrations and animations which can be accessed via mobile technologies and software platforms for accessing educational resources for sustainable learning. In formal education settings (i.e. schools), the transition to mobile learning is one of the most established learning trends that remain a virgin area for future exploitation. Similarly, new approaches to content development and delivery modes are moving away from PCs and desktop computers to portable devices that can accommodate visually rich multimedia interfaces with interactive and collaborative learning futures. This paper examined the concept of multimedia and mobile learning, the current state of multimedia mobile learning in Nigeria and its future trend and challenges. Furthermore, the design and development of multimedia content for mobile learning devices, with a focus on the implication of multimedia design principles for developing mobile learning content were elaborated.

Keywords: Multimedia, mobile learning, future trends and sustainable development

Introduction

Education is seen as key in the process of achieving sustainable development. However, in order for formal education to contribute to sustainability, traditional systems of instructional delivery need to be re-oriented to adopt multimedia mobile learning technologies for easy access, storage, retrieval, presentation and exchange of information by electronic means. Nsofor, Bello, Umeh and Oboh (2015) held the view that multimedia mobile learning can expand learning opportunities for students to learn anywhere and anytime; create new learning scenarios for students with special focus on improving learning in schools. Specifically, new learning opportunities are largely fashioned and conveyed using mobile technologies such as personal digital assistants (PDAs), smart phones, MP3 and MP4 players

and other portable multimedia players like handheld gaming devices, ultramobile PCs (UMPCs), handheld GPS devices all supporting sustainable mobile learning. These technologies according to Pocatilu and Boja (2009) have the ability to expand learning opportunities of students using approaches such as multimedia games, SMS text messages, e-mail and voice communication to support students' learning and to promote their participation in Web communities. This is largely due to the fact that these technologies are ubiquitous, mobile, connected, and personal; their ability to support one-to-one computing will create the potential for a new phase in the evolution of technology-enhanced learning, characterized by the diversification in sources of information, the continued acceleration in the production of and circulation of ideas and opinions. Supporting this idea, Nsofor, Bello, Umeh and Oboh (2015) presumes that because these technologies are personal, learners are more comfortable engaging in learning key subject areas using a mobile device than doing so using desktop computers.

The focus of this paper is how students learn from words and pictures in a mobile device as opposed to previous studies where multimedia learning content were developed and delivered via PCs and desktop computers (Gambari, Yaki, Gana & Ughovwa, 2014; Bello, 2015). It explores the next step on the continuum for designing multimedia learning resources for a more ubiquitous portable device like the mobile phone thereby making learning interactive, visually engaging, and effective. This trend of learning is informally emerging among students' which can be witness through exchange of multimedia massages, voice, pictures and videos via Facebook and Whatsapp application and it is a mark of independent and sustainable development. As such, new pedagogies and learning assessment methods may be required, while recognizing that learning is increasingly happening individually beyond formal educational settings.

The Concept of Multimedia and Mobile Learning

Multimedia mobile learning uses audio, graphics, animations, and video to communicate with multimedia related hardware through device drivers. The audio and video resources involve playback and recording capabilities which support the development of additional multimedia content by an individual or group of students. Multimedia learning via mobile phones as noted by Spector (2013) can be relevant in teaching various school subjects and can be considered the best option for teaching 21st century students who are often addicted to mobile phones. According to Mayer (2009) multimedia is the combination of computer hardware and software that allows for careful integration of video, animation, audio, graphics, and text resources to develop effective presentations on an affordable desktop computer. Thus, extending the multimedia content beyond desktop computer to mobile phones can make learning more meaningful and timely. This is due to the fact that access and ownership of mobile phones is more within the means of students and parents than desktop or laptop computer.

Mayer and Moreno (2005) noted that multimedia content are designed and distributed as stand alone or through online instructional presentations, interactive lessons, e-courses, simulated games, virtual reality, and computer-supported in-class presentations. The key to providing this experience as noted by Pocatilu, and Boja, (2009) is having simultaneous graphic, video and audio, rather than text alone. Multimedia explicitly adapts well to individual learning differences due to its degree of learner control and the ability to map too

many learning styles. Downey (2008) stated that traditional learning relies heavily on reading text devoid of illustrations and visualisation which presents ideas in abstract form. However, multimedia offers an alternative medium of instruction to the current learning process by providing a dynamic illustration (animations and video) which gives more support for learning and retention.

Mobile learning according to UNESCO (2011) refer to a combination of hardware, operating systems, networking and software including content, learning platforms, and applications. The key component of mobile technologies include mobile computing and wireless technology that enable the integration of learning through mobile phones which has the potential to interrupt conventional paradigms. Suzanne (2009) noted that mobile phones are becoming more technically sophisticated, different from traditional learning tools such as books, chalk, pen and pencils because they enable instantaneous access to vast and growing reservoirs of information anywhere and at anytime. These technologies can create and play multimedia content since they have high quality colour screens. Athraa and Esra (2015) added that many models of mobile technologies can capture, edit, and play back video, audio, and photographs and run Flash-based interactive applications (through Flash Lite). They also have greater storage capacity, and network connectivity through Internet with Bluetooth and WiFi. These paradigms according to Nsofor, Bello, Umeh and Oboh (2015) provided students with a unique ability to communicate and share knowledge between individuals and groups independent of time and physical location resulting to a general transformation of formal and informal learning. Subsequently, these have shown that mobile phones can enable literacy development, promote student motivation, enhance access to teacher development opportunities, and improve communication between parents, teachers and principals.

Consequently, Martin (2010) added that exploiting the use of these devices for multimedia resources via mobile technologies which are known to engage and motivate students could be a powerful way of providing learning materials to students who need more flexible learning solutions. This is specifically made manifest by presenting multimodal channels that enable students to build up their own knowledge representations of task in hand and identifying the gaps in their own knowledge and hence assist in successful comprehension of information (Soloway and Norris 2005). Supporting this idea Athraa and Esra (2015) argued that collaborative learning and sharing of content is what student's does spontaneously among themselves through massive social networking via mobile phones. With this therefore, transforming and conveying multimedia learning contents to mobile phones will be a step toward making information handy and within the reach of most students thereby narrowing the role of the teacher from bank of knowledge to a facilitator of learning. Owning to this advantage, Suzanne (2009) noted that mobile phones improves learners' organisation and time management due to using calendars, tasks, reminders and alarms on handheld technologies.

The current state of Multimedia Mobile learning in Nigeria

Mobile technologies are originally manufactured mainly for communication and entertainment purposes, however, with continue improvement, these devices have come to play a significant role in nearly every field of human endeavour and are currently being used to increase productivity and sustainability in numerous sectors of the economy. Currently, students are prime users of mobile technologies mostly for social interaction and

entertainment and are rarely use for learning. This is made manifest with the availability of smart phones in the hands of almost every adult in Nigeria. As such, key educational experts and researchers such as Minjuan and Ruimin (2011) have experimented with supportive learning theories the innovative use of mobile learning in both formal and informal education settings. Many of these experts held the view that mobile learning is now on the threshold of a systematic integration with education both in and outside of schools. As a consequent, Vavoula and Sharples (2009) remarked that schools craving for development have started using desktop and laptop computers in the classroom while others are in the process of experimenting the use of interactive white boards for teaching and learning. The gradual upshot of using these devices is that, they are static and require steady electricity to function well and this is still a challenge in Nigeria. For this reason, Ananny and Winters (2007) lamented that many of these devices have failed to have a positive impact on education. Nevertheless, the potential of mobile learning usage seems to be universally accepted, but the question of how best to incorporate multimedia content to support learning is a work in progress.

Pocatilu, and Boja, (2009) commented that one viable way to convey multimedia content for learning is to have students use the mobile devices they already own. This form of learning will cause a major shift in education by allowing more students to access course materials via mobile technology. Similarly, Minjuan and Ruimin (2011) claimed that as Smartphone and tablet access and ownership increases, the use of multimedia mobile learning will increase. For example, a number of tutors running home lessons and extramural classes have started using SMS (Short Message Service) on standard mobile phones to provide students with access to English and mathematics content to support learning. Thus, multimedia mobile learning in Nigeria is progressing in a fast lane and is demanding for more attention towards sustainable development.

The future trend and challenges for Multimedia Mobile learning

The future of multimedia mobile learning is bright, and experts have submitted that in some years to come mobile devices will be integrated with mainstream classroom learning in the same way as computers are in schools (Nsofor, Bello, Umeh and Oboh, 2015). These emerging trends will drastically shape instructional delivery modes, monitor the progress of learning and present summative assessment of students in forms that can employ the use of mobile devices. Certainly, with the advent of these innovations, it is important that educators understand the wherewithal of these technologies so as to influence their skill development rather than simply react to it. In particular, the future trend and core challenges for multimedia mobile learning are summarised below;

- **Increase in accessibility, affordability and functionality of mobile technologies**

A sharp increase in functionality of mobile technologies such as battery life, portability, connectivity and storage capacity at lower costs is the focus for mobile technology developers, thus increasing their availability in the market and hence makes them affordable to almost everyone. Furthermore, increased availability and penetration of 'smart' mobile devices and cloud-based services with advanced functionalities will open up a world of new possibilities for mobile learning solutions, allowing the types of initiatives among the community of learners to be replicated on a large scale mounting pressure and questioning the status quo of how education is delivered and assess. These left many in anticipation that the revolution in learning continuum may likely occur as a bottom up approach where

students become the agents in the revolution process. Indeed, the challenging aspect of this development is how the community of learners respond to these new possibilities.

- **Provision of new data plan for schools**

As a matter of policy, mobile communication providers in a near future will make special consideration for schools requiring internet access. Current uses of data plan is not feasible for students but in a near future, new and more competitors will emerge making the data for browsing accessible to all mobile technology users. This will enable a more personalized and contextual learning through mobile technology with an increased companionship between learners and their devices.

- **Improvement in energy sources**

A steady source of power has been a challenge in supporting mobile learning programmes, particularly in developing countries where access to electricity is often unreliable or unreasonably expensive. Therefore, high expectations are placed in the production of cheaper, longer lasting and faster charging batteries and the emergence of alternative energy sources, such as quality power banks and inverters, solar systems and wind power.

- **Training teachers for multimedia design and development**

Training classroom teachers to develop multimedia mobile learning content is a new trend toward achieving a goal for the mobility of learning. This development will however challenge teachers to assume the responsibility of becoming designers and developers in their own disciplines leading to a new paradigm in teaching and learning. One of the key challenges in the development of mobile learning is limited number of trained practitioners who can effectively develop multimedia mobile learning content. The significant challenge in this aspect is teachers being computer illiterate. As such, training teachers in the innovative design and development of mobile learning coupled with strategies for its implementation will be a means of advancing student learning.

Multimedia Design Principles for Developing Mobile Learning Content

Designing effective multimedia mobile learning contents requires a holistic understanding of how multimedia design principles intersects with recent mobile phones while equally considering the social, cultural and, commercial factors. According to Clark (2001) and Mayer (2009) the six fundamental principles for designing multimedia learning are based on cognitive theory, and more specifically on cognitive load theory and information processing theory. The multimedia design principles have been successfully applied to desktop computers in different subject areas. The question that comes to mind is; can multimedia design principles be applied in the design of multimedia content for mobile phones having smaller screen size and resolution of 128 x 160 pixels with a two- inch-wide display as against large screen sizes and resolutions of 1024 x 768 pixels for PCs and desktop computers? Reacting to this, Clark (2001) and Mayer (2009) proposed that these design principles as discuss below can be equally relevant to mobile phone application with the following considerations;

- **The multimedia principle**

The multimedia principle state that, *Students learn better from words and pictures than from words alone.* This principle is concern with building a mental connection between verbal (the written words and sounds) and pictorial representations (graphics, video and animations). Mayer (2009) recognizing that words supported by pictures benefit and facilitate learning

more than words alone. Conversely, in designing for smart phone devices, Balaban-Sali (2008) remarked that the instructional designer should consider creating text with smaller fond sizes and apply graphics with popup text if possible and limit scrolling to barest minimum.

- **The modality principle**

The modality principle state that, *Students learn better from animation and narration than from animation and on-screen text.* The principle gives credence to the mode of media presentation of content requiring animations and narration. For example, audio can be use instead of written words in order to leave more space for display of other types of content (text and graphics) for significant gains in learning and reduce the reading stress. Ananny and Winters (2007) proposed that in situations where words are necessary either for mastering of steps, procedures, or complex functions such as mathematical formulas; text can be use with all sort of caution. However, information presented inform of animation should be converted to HyperText Markup Language (HTML) for delivery to keep the file weight low and ease the download problem while narration should be converted to MP4 short and provide headsets to users.

- **The contiguity principle**

The contiguity principle state that, *Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen.* Generally, experts in the field of multimedia, Mayer and Moreno (2005) suggested keeping text close to its corresponding graphic or animation helps to make smooth the progress of learning and assimilation of information. While designing for mobile phones, a text or caption can be entrenched within the graphic to illustrate a certain action using a mouse-over, popup menu, or an icon to generate additional information on demand. A Flash Lite platform has the capabilities for achieving these and can be a better option for managing screen display for mobile phones or related technologies. Based on cognitive load theory, better outcome can be achieve once feedback appears on the same screen display as test question with the main content because separating rudiments of learning possibly will create cognitive burden and would therefore not be conducive to learning.

- **The redundancy principle**

The redundancy principle states that; *Students learn better when information is not represented in more than one modality – redundancy interferes with learning.* This principle is concerned with getting rid of redundant information on the screen. This implies that information represented in one form of media should not be repeated in another form. For instance, a narrated information should not be written in text form, similarly, an animated content should not be represented in video or picture form. Thus, to satisfy the demand of redundancy and modality principles, it is preferable to have text narrated only, especially if the narration simply reads exactly the text showing on screen than having text and narration together. This is based on the consideration that mobile device have small size screens with limited storage capacity. Based on these concerns, it was suggested that instructional designers designing content for multimedia mobile learning should avoid duplicating information.

- **The coherence principle**

The coherence principle states that; *Students learn better when extraneous words, pictures, and sounds are excluded rather than included.* Considering the fact that mobile phones do

not have large storage capacity, complying with coherence principle suggest removing any distractions such as; depicting colours, unnecessary sounds, background music and stylish text, which does not contribute meaningfully to the lesson. Studies of Balaban-Sali (2008) revealed that adding unnecessary graphics and sounds do not contribute meaningfully to learning and may overload working memory and distract the learner. Thus, this principle cautioned multimedia instructional designers for mobile phones to avoid using information that is not related to content and context and stay away from adding illustrations, composition, or background noises to the instructional content.

- **The personalization principle**

The personalisation principle states that; "*use conversational styles and virtual coaches rather than formal styles"* (Clark & Mayer, 2011). The personalization principle suggests that multimedia instructional content should be designed by creating a conversation that engages the user using the first or second person singular in narration or written text. This is based on the presumption that students can interact with the mobile device in a way that resembles teacher to student's conversations. According to Clark & Mayer (2011) students learn better when the content is conversational rather than a formal style in both texts and audio narrations. The key to personalizing multimedia instructional content is by engaging students with the mobile devices and its contents as a social companion. These engagements can be made using approaches such as coach, or pedagogical agent, to support learning. An agent is a character that can be exposed visually on the screen in form of (virtual images, cartoon-like character or represented verbally through human recorded voice) that will interact and guide the learner during learning process. On the mobile device, a visible agent may take too much space, therefore, an audio agent could be use to do the trick or by placing a small icon on the screen to identify an agent. When needed, or based on user interactions, the agent could pop up and then hide when done.

It is hoped that multimedia instructional designers can transfer their skills and talent to developing multimedia instructional content for mobile phones, while holding on firmly to these designs principles. Given that recent advances in cloud computing and bandwidth availability support multimedia mobile learning designers to convey audio, visual and interactive contents to students in real time. However, development software, such as Learning Mobile Author software enables designers and developers to create a learning application using graphics, text, and multiple-choice questions, including Web links. Additionally, Flash Lite, Adobe Captivate and Camtasia software allows experts to package their knowledge for asynchronous distribution while others package and deliver content via Web-based platforms (iPhones, smartphones, and 3G enabled tablets) and Standalone applications (iPods, mobile media players, e-books and laptops).

Rationale for Multimedia Mobile learning

The use of mobile technologies for playing instructional multimedia based content in teaching and learning can encourage and support learning at any time of day, in any location including in hostels, classroom, home, place of work, field trips and in transit. Helen, Angela and Tasman (2014) added that this innovation can make learning more convenient, accessible, inclusive and sensitive to learners' individual needs and circumstances. It will explicitly make learning more interesting, enjoyable and attractive to learners by encouraging non-traditional learners and dropouts to reinitiate their optimism and self-confidence in learning since learning becomes play and fun different from too much reading and writing. In

support of this, Nsofor, Bello, Umeh and Oboh (2015) remarked that multimedia mobile learning can improved independent learning, ownership of learning, self-motivation and participation in extra-curricular activities in both physical and online classrooms. In addition, evidences of increased rate of completion of classroom activities and achievement for weak and slow learners, access to on-line materials and relevant multimedia learning content for skill development through mobile phones have been reported by Athraa and Esra (2015). Interestingly, students can create multimedia content by capturing images and videos via inbuilt cameras on their phones, format or edit the images and videos, store or share them to peers from distant location.

Teacher developers can be more desirous seeing their students understanding the learning content, therefore, multimedia mobile learning can empower teachers to provide differentiated learning tasks and styles that engage different ability levels of students. At a successful completion of a lesson via mobile phone, teachers can use the medium to support a dialogue in synchronous or asynchronous mode with learners to evaluate their learning progress and feedback regardless of their location. Balaban-Sali (2008) confirmed that additional learning resources and guidance can be given to learners in remote locations which encourages and support both independent (revision of missed lessons) and collaborative learning (peer assessment, evidence-gathering and quality feedback) from the two parties.

In inclusive education settings, Hourcade, Bullock-Rest and Hansen (2012) noted that multimedia mobile learning can serve as an assistive technology in supporting learners with special needs by engaging them with multimedia content having animations, narrations and videos thereby eliminating the demand of reading aloud and writing due Down syndrome and rheumatism which can prevent mental coordination. This is made possible with younger generation of students who automatically understand new technology and require no training to use them – the 'digital natives' concept (Spector, 2013). Multimedia mobile learning thus, is an approach to make education available to the populace irrespective of age, gender, ability levels, ethnicity, creed and time. Nsofor (2010) noted that any nation so desirous of sustainable development must have all hands on deck through education irrespective of all divides.

Conclusion

Multimedia mobile learning possesses attributes of formal and informal learning, personalized and social learning, learning at all times and locations, as an alternative and supplementary learning models that will become more prevalent as mobile technologies improve and spread. Conversely, as mobile technologies improve in quality and decrease in price, this movement towards multimedia mobile learning could increase educational opportunities for learners in developing countries, particularly those who do not currently have access to high-quality print materials. Therefore, the mobile devices will be major delivery vehicles for multimedia learning content in the coming decades and hopefully will culminate in sustainable development.

Recommendations

- The government should promote partnership and coordination of seminar series, research roundtables, and international symposium among teachers on the design and development of multimedia mobile learning.

- State and Federal government should facilitate the development of a digital library to highlight findings from multimedia mobile learning case studies and identify best practices for adoption.
- It is essential that partnerships and agreements are entered into by the federal government to help reduce and subsidize the cost of mobile data for the end users of the technology and ensure the stability of the internet facility.

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