Education on the Move, the role of Smart Mobile Phone Devices in Virtual Learning

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Abstract

For clarity and consistency, the term Smart Mobile Phone devices as used in this paper refers to mobile devices with the capability of accessing the internet and which have the capability to store the content accessed and downloaded from the internet. These devices have a display screen which can be used to read materials, input text material and access online learning resources.The learning that takes place on the mobile devices virtually is referred to as mobile learning(m-learning). M-learning is the direction in which e-learning is pointing to. This paperconducts a meta-analysis of the place of smartphone devices in thee-learning sector, the challenges of m-learning and the need of changing focus to m-learning given the increasing use of mobile devices across all divides. The articledescribes the role of smart mobile devices in m-learning and also suggests how best the associated challenges can be solved to enableseamless integration of m-learning into the current education system in order to achieve learning anywhere anytime.

Keywords: Virtual Learning, m-Learning, Smartphone Devices, Technology, Learning Management Systems.

I.   Introduction:

Mobile phones have been widely accepted in almost every aspect of life in the world. Students, lecturers, parents and administrators are using mobile devices mainly for communication both calls and text messages. Before the invention of the computers, laptops, smart mobile phones, internet among other technologies, (Pham et al, 2019), learning was through paper and class-based face to face modes. The invention of computers, e-learning and mobile phone devices have changed the approach to learning to an extent that learners can now log into desktop computers, laptops and tablets for the purpose of retrieving learning materials and also for attending online classes via Learning Management Systems (LMS). According to Chow & Shi (2014), higher education has not been left behind, learners at the institutions of higher learning have embraced the use of mobile devices to an extent that the physical use of libraries in these institutions is increasingly becomingnegligible. This paper focuses on the role played by mobile phone devices in providing a suitable and alternative platform for learning in institutions of higher learning. The key question being asked is, 'what is the role played by smart mobile devices in enhancing learning anywhere anytime?'

Smart Mobile Devices are an innovative approach to the delivery of educational services with the support of the internet in order to enhance knowledge, skills, and other outcomes for learners (Fazlollahtabar&Muhammadzadeh, 2012).A typical context that elaborated the worth and role played by the mobile devices in learning is during the Covid-19 pandemic: withlearning institutions shut down in order to prevent the spread and impact of the virus, most learners had no access physical learning. Computers were also inaccessible and going to the cyber cafes to complete their assignments and to engage in online learning was not possible either due to the lockdown. Learners and teachers resorted to using the mobile phones to conduct the learning activities that could otherwise be done through physical meetings or using desktop/laptop computers. Meetings, lectures and other instructional activities were attended and conducted online via smart mobile phones. These actions point to the fact that the growing importance of mobile devices in learning cannot be over-emphasized.

1.   Smart Mobile Phone Devices

According to research done in computer hope, (Computer-hope, 2019) the first smartphone device was developed in 1993 by IBM's Simon. It had the capabilities of sending and receiving emails, had telephone contact list, address book, calculator, calendar and notepad. It was called the Simon Personal Communicator. A smartphone device is a cellular phone running off an operating system like android and has capabilities not

limited to calling and sending of text messages. It is capable of accessing the internet (web browsing), using GPS, Bluetooth, voice detection, e-book reader, playing and recording sound, take and store video and image graphics among other functionalities (Alyssa, 2017). (Kumar, 2013) describes smartphone as a cellular phone with high-resolution touchscreen display, Wi-Fi connectivity, Web browsing capabilities, and ability to accept sophisticated applications. He also specifies that majority of the smartphone devices run on any of the popularly known mobile operating systems such as: Android, Symbian, iOS, BlackBerry OS and Windows Mobile.

With the increased technological advancements and affordability of a range of smart mobile devices, access and use of these devices have highly increased over the decades to an extent that every household have at least one smart mobile device with the capability of accessing the internet.

According to Dafau et al(2011), the number of smartphone users worldwide was expected to exceed one billion by 2013. That number has exceeded one billion and as at 2022, the number of smartphone users in the world today is 6.648 billion, which translates to 83.37% of the world's population owning a smartphone. In total, the number of people that own a smart and feature phone is 7.26 billion, making up 91.16% of the world's population (Global overview report, 2021). Undoubtedly, smartphones have become a part of every person's daily lives. By taking advantage of such massive use, these miniature pocket computers can revolutionize instructional processes and learning in education. Richard (2020), while trying to find the position of learning via mobile technologies, he answered the following three questions: Do students learn academic content better with mobile technology than with conventional media (media comparison question)? Which instructional features afforded by mobile technology lead to learning (instructional method question)? Under what conditions do students learn academic content better with mobile technology than with conventional media (boundary condition question)? His findings pointed to the fact that learners learn better on mobile devices than on conventional paper and that the general information accessed by the learners on the internet was those posted by both bloggers and scholars. Additionally, he found that learning took place anywhere when learners had access to mobile phones; this could be while at home, at school, while travelling or even while socializing.

Mobile learning therefore makes adapting increasingly private and an individual issue just as it makes learning conceivable in formal and casual circumstances. Most importantly, the use of smart phones makes it essential for educationist to discover new and innovative methods for using new technology and pattern in teaching and learning (Kumar, 2020).

2.   Smart Phones and Virtual Learning

The use of virtual learning in dissemination of learning materials and content is continually increasing. Many Learning Management Systems (LMS) have been developed that are either open source or commercial. Institutions of higher learning have vastly adopted the use of e-learning with some having complete e-campuses.

Virtual learning is the learning process in which internet is used in order for learning resources to be accessed and shared by teachers and learners separated by geographical boundaries. Using smartphones or mobile devices in order to facilitate virtual learning has led to a new learning paradigm referred to as **m-learning** (which is the learning supported by the mobile devices having access to the internet). The term "mobile learning" is still evolving and its exact meaning is still not clear. However, Traxler (2007) points out some key words to explain this concept such as personal, spontaneous, situated, private, and portable to explain mobile learning.

Given that virtual learning entails video conferencing, LMS platforms, web access of e-books and even virtual library; smartphones have the capability to offer the platforms and the environments upon which these activities can be performed (Brooks, Brooks, & Vidakis, 2017). Mobile phone devices also offer video conferencing platform applications such as Zoom, Google meet, Team viewer among others which have been used effectively in meetings and other collaborative activities. The compatibility of LMS like Modular Object-Oriented Digital Learning Environment (MOODLE), Blackboard Learn, Desire2Learn among others, with smartphones have also increased the ability of smartphone users to access these learning platforms without having to log into the desk top computers in order to access them. (Papadakis, Kalogiannakis, Sifaki, & Vidakis, 2018)

Materials posted on the LMS can be accessed eitherby learnerslogged on computers or on mobile devices provided there is internet availability. Most applications that can open documents on the desktop computers are also found on smart phones. (María, et al. (2017) & Mohammadi et al.(2020). For example, Portable Document Formats (pdf), word documents, images amongst other document formats can be accessed by the mobile devices easily without complications provided the right application is installed. There are therefore minimal challenges in accessingdocumentsby mobile deviceusers. Computer are bulky and stationary and when needed one has to physically sit where they are stationed. Mobile devices therefore have an edge over computers due to its mobility and ease of access (Mohammadi, Sarvestani, & Nouroozi, 2020).

M-learning can help in ensuring that learning continues even if learning environments are compromised by situations like that witnessed during COVID-19 pandemic (Salas-Rueda et al, 2022). The development of LMS and applications that can support learning on smartphone devices can ensure that learning

is not hindered by the geographical boundaries or space between the learners and their teachers. Smartphone devices have been used by learners to successfully perform such activities as social media interaction and general communications. The mobile phone has become part and parcel of every learner, therefore, introducing learning using the smart mobile phones will face limited resistance (Dingli & Seychell, 2015). Shifting focus to learning systems used on mobile devices in order to support learning will effectively and continuously change the manner in which learning is conducted. By embracing m-learning, learning will no longer be limited to the four walls of a classroom, rather it will be available to all learners with access to a smart phone. In addition, instruction will be more individualized and thereby creating that personal touch that learners miss in a physical classroom that has a very high teacher to learner ratio.

3. Challenges of implementing m-learning

With the mobile devices in the hands of the learners either provided by the respective institutions or owned by the learners themselves, m-learning is facing a series of challenges that needs to be addressed by devices manufacturers, institution administrators and application developers. According to Nik Masturaet al (2012), the key challenges faced by m-learning includes learning material design for mobile devices. The focus of developing learning material designs has been such that they are meant for desk top computer devices. Developing learning materials that are accessible both on desk top computer and mobile devices has proven to be a great challenge to educators. It is the role of educators to develop learning materials and facilitate the process of learning (Aung & Khaing, 2016). However, educators might lack the technical know-how on developing content compatible for learning using mobile devices. Another challenge identified was issues affecting implementation of m-learning in education; dealing with connectivity and battery life, avoiding the risk of distraction, measuring the results, finding the value of going mobile (Papadakis, Kalogiannakis, Sifaki, & Vidakis, 2018).

Given the nature of m-learning which tends to support learner centered learning, learners' individual differences is taken care of since learning is self-paced and learners have control of their learning (Haji, Shaame, & Kombo, 2013). However, distractions arise that might result in delayed learning processes. These distractions are as a result of applications such as online messaging in social media chat platforms like WhatsApp, telegram, Tik Tok, Facebook and others. M-learning is still a developing field, consequently, measuring the results of m-learning tends to be a great challenge. Assessing whether learning has taken place and the learner has mastered the concept from m-learning might be a hurdle because of challenges associated with the mobile device (Nik Mastura, et al, 2012).

The table below illustrates the challenges of m-learning according to N.Y. Asabere (2013), F. B. Osang (2013), Y. Mehdipour et al (2013), Chengjiu, Yanjie, Yoshiyuki, Hiroaki, & Gwo-Jen, (2013) and (Kelsey, 2021)

Category of Challenge	Identified Challenge
Technical challenges	❖ Network connectivity and bandwidth, ❖ Battery life, small screen size and key size, ❖ Limited memory size, ❖ Layout of content when viewed on emulator compared to on real device, ❖ File format support, ❖ Several developer proprietaries ❖ Compatibility issues
Security challenges	❖ Device content security, ❖ Piracy and copyright infringement, ❖ Theft of device, ❖ Misuse, virus and malware
Social challenges	❖ End users' inability to access and afford the cost, ❖ Lack of basic skills, Training and support, ❖ Negligence of socially disadvantaged and physically challenged individuals, ❖ Lack of self-confidence in ICT use and application
Pedagogical challenges	❖ Adaptation of present e-learning resources for m-learning, Capability to execute content of m-learning, ❖ Conversion from teacher centered to learner-teacher method,

	Assessing learning content outside the schoolroom,
	❖ Suitable learning model and learning theory,
	❖ Coping with theoretical dissimilarities between e-learning and m-learning,
	❖ Planning and implementing of innovation for lifelong learning, Assessment of outcomes of m-learning implementation,
	❖ Lack of constraint on learning schedule,
	❖ Lack of demographic border, possibility of getting distracted
Peculiar challenges in developing country scenarios	❖ Poverty and affordability,
	❖ Lack of infrastructure and Network issues,
	❖ Insecurity and Political instability,
	❖ Government inadequate policy plan and implementation,
	❖ Issues relating to poor acceptability,
	❖ Stakeholders' negligence of education,
	❖ Limitation to technology accessibility,
	❖ Poor awareness among teachers

4.   Ways of diversifying the learning experiences on the smart mobile phone platform

Learning on smart mobile devices can be diversified to increase the learners ability to achieve instructional objectives (Kelsey, 2021). He clarifies that creating short videos, use of mobile phone friendly simulators, mobile dictionaries and thesaurus, the use of podcasts and reading of digital academic papers on the smart devices and phones can diversify how the learners lerning experiences and enable their achievement of set goals (Kelsey, 2021).

Niwat & Prapaporn(2014) in an experimental study on the use of mobile simulations for conceptual learning found out that the learners' conceptual understanding improved after using mobile based simulators. The study suggested a need to investigate instructional activity for mobile learning by incorporating simulation-based inquiry. Mobile simulated learning allows for an interactive and collaborative way of learning (Diez-Echavarria, Alejandro, & Lorena, 2018). The social aspect of humans is catered for through interaction and collaboration using simulations. They also developed a simulation model with an agent that represent students to help them make decisions on whether they want to attend classes physically or virtually. Mobile simulators allows learners to interact learning environment similar to the real world situations inorder to understand the conceptual knowledge (Chengjiu, Yanjie, Yoshiyuki, Hiroaki, & Gwo-Jen, 2013). Their findings concluded that, goal-based and scaffolding approaches, if integrated in simulations design, improves students learning in augmented reality. The students who are exposed to to scaffolding using mobile phone simulators also gains significantly higher accuracy rate in perfoming similar tasks.

According to Ellie (2018), in a research conducted in Cornerstone university, MOODLE is used in mobile phones for learning, in which the learner gets access to customized learner friendly applications. Learners are able to record videos of the lecturer while in class in order to avoid missing on key points on explanations. Other approaches embraced include the use of Note Taking Applications, Listening to Podcasts, the use of video application to record presentations, managing of the calendar notifications from the phone, setting timers and consulting supervisors and professors using mobile phone communications applications.

SplashLearn(2022) agrees that Smartphones can be used as better research tools. Open Data Kit (ODK) has been developed to allow researchers collect data from the field without using printed paper questionnaires (ODK, 2021). Google forms have been developed by google to allow researchers also get realtime feedbacks from the researchers in the field (Justin & Cupcakes, 2014). This can be used in learning for assessment purposes, evaluation surveys and getting students entry behaviour information. Entry behaviour information facilitates proper planning of learning activities for the learner by the teacher. SplashLearn further indicates that besides being used as a research tool, Smartphones can be used to take snapshots of the lecture notes, use of e-reader alternatives, used as diaries for activities, tracking of students behaviours amongst others

5.   The role of the teacher in mobile learning

Technology is not sufficient to provide learning without human intervention. In mobile blended learning, it is the role of the teacher to restructure learning strategies and show attention to the students giving them more space to engage effectively in the learning process (Kadek, 2019). Mobile learning has become the main promoter and accelerator to development of instructional learning applications for mobile devices. These devices can systematically guide the teacher in planning processes for online learning.

Shafika(2012) in a study to explore the potential of Mobile Technologies to Support Teachers and Improve practice found out that poverty in African developing countries with regard to acquisation of educational technologies fo pteaching can be avoided deploying mobile leanring application to teachers who cannot afford Personal Computers (PC). In a project titled "road to reading" in South Africa, (Mafenya, 2019) indicated that peer support, teacher collaboration and overcoming technophobia are key drivers to teachers successully adopting the good ideas of Mobile learning amongs teachers. Proper training and mobile instructional material designs are alo key factors to be considered while planning for successful mobile teaching.

The preferred learning instructional design for mobile learning is the matrix model. This model allows representation of the harmony between the components of instruction and tends to be effective in the design and alignment of instructional material (Kadek, 2019). This, the author argues, is the best model for designing mobile learning instructional materials by teachers. Mobile learning and teaching processes can be affected by competing interests of social media applications installed in the smartphones(José-María, Inmaculada, Francisco-Javier, & María-Pilar, 2020). There is therefore need to ensure mobile applications for learning takes control of the entire device to prevent other applications from sending visible notifications during mobile learning processes in classrooms or individual based learning cases.

II.   Recommendations

Given the increased usage of mobile devices and new technologies, the rate at which learners' access smartphones is high. However, the devices are not being utilized for academic purposes rather, they are used for gaming, social media, video streaming for movies among others.Academic institutions should make it a policy and develop learning materials that are mobile friendly and appealing to ensure that the learners can frequently use the mobile devices for learning more than for other activities.

A lot of distractions can be experienced while using mobile devices, in order to curb these distractions, the learning applications should be on lock such that once the learners log into the learning system, the only interaction should be with the single learning application without interferences that come from other non-academic applications (Kadek, 2019). With this in place, m-learning success rate will increase and the learners will benefit from the use of mobile devices in learning.

The compatibility issue for learning platforms and mobile devices, file formats issues, connectivity issues and other technological challenges can be addressed in order to ensure perfect integration of m- learning. Institutions should ensure that the software's or the platforms that are used for learning can be used in the least specification devices to allow all the learner to be able to use their phones without going for more complicated mobile devices. The compatibility issue can be solved by enhancing the simplicity of the mobile platforms used for learning given the limited capabilities of mobile devices compared to desk top computers.

In order to ensure that peculiar challenges in developing countries like Kenya are solved, it should be a matter of policy in the education sector in conjunction to the national government to ensure that every county in the country have access to the minimum network connections to facilitate the use of m-learning. Otherwise, the learners will continue to experiences outage in terms of network thereby preventing the learning from taking place.

Pedagogical challenges can be solved by ensuring that the theoretical dissimilarities between e-learning and m-learning are harmonized. This is achievable only if the contents developed for mobile devices have a backward compatibility to those that are used for e-learning. Given that the future of learning is clearly pointing to m-learning, the material development and platform development should also focus on m-learning. Other pedagogical challenges like learning shifting from teacher centered to learner centered should also be addressed by allowing the learner to dictate how they want to approach the learning process. They have the mobile devices on their hands and therefore the decisions to engage in the learning process is also on their hands.

On social challenges, the learners' aggressiveness towards having the knowledge to use mobile technology is higher than the teachers' aggressiveness. Therefore, the if the learning process on mobile platform is made interesting, then the aggressiveness of the learners will be a rewarding act since the same effort will be redirected to the learning process.

Security challenges of m-learning in the developing countries such as device theft, plagiarism and copyright infringement, malware and virus attacks has also proved to be a great challenge. These can be solved by ensuring the learners are properly trained on the device use. The learners should be aware of how they can detect and handle malwares and viruses on mobile devices. The aspect of plagiarism can also be solved by ensuring that the anti-plagiarism software is integrated to the m-learning platform. This will prevent the aspect uploading materials that are plagiarized and those that own copy rights. The institutions should also integrate the technology with the capability of tracking and monitoring the learner devices such as the GPS, in order to understand the learner locations and also in case there is theft of the devices, the devices can easily be tracked.

III. Conclusions

M-learning technology has an incredible potential to upgrade the learning experience and add to higher scholarly outcomes for all students. In any case, the simple presence of m-learning in the classroom isn't sufficient to accomplish this. Instructors need to utilize it at its maximum capacity. So, they need all the help in case they are to beat all the above difficulties of mobile learning and to reclassify the job cell phones play in the classroom

According to (Brown, 2014) the potential for m-learning in developing countries in Africa is still not fully exhausted due to lack of enhanced technological developments such as in Africa continent that are technologically far behind the developed world, and this lack of technological development has a detrimental effect on the education sector. As a result, young people in developing countries face immense challenges, which make it difficult for the next generation to catch up with the developed world.

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