The Use of Mobile Computing in Technical and Vocational Education Institutions

By

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ABSTRACT

The motive for this study was to assess how polytechnic students and lecturers were using mobile computing devices for teaching and learning both inside and outside the classroom and how actual student use compares to lecturers' perceptions of student use. The researchers used Gweru Polytechnic and Kwekwe Polytechnic as case studies and data was collected through interviews and questionnaires administered to lecturers and students. The findings revealed that the implementation of mobile learning in polytechnics had some challenges including internet connectivity and high mobile data costs. While lecturers believed that students were primarily using mobile devices to socialize, students reported that they were performing a wide variety of educational tasks. Although some lecturers banned the use of mobile devices in the classroom and prefer mobile learning to remain outside the classroom, students believed that more formal uses both inside and outside the classroom could be beneficial. Students seemed more ready to fully adopt the use of mobile devices for learning while lecturers are somewhat concerned that devices may be distracting and limiting. The researchers recommend increased dialogue amongst stakeholders about the learning opportunities available through mobile devices.

Keywords: *mobile computing, mobile education, technical education.*

Introduction

In Zimbabwe's higher education institutions, mobile computing has become an invaluable and inevitable part of the administration, teaching, and learning. Polytechnics, in particular, have played their role in embracing ICT computing, though at different paces and priorities. The researchers intended to assess the use of mobile computing in Technical and Vocational Education. The study was carried out at Gweru and Kwekwe Polytechnic Polytechnics two of the Technical and Vocational Centre's in Zimbabwe.

Background to the study

During the period before 2003, Zimbabwe Polytechnics had a mix of Information Communication Technologies (ICTs), which varied from one institution to another. There was no uniformity as to what ICTs institutions invested in. While some polytechnics had several clone desktop computer laboratories, some did not have even a single computer. While some had connected to the internet using the telephone line-based dialup system, some had no idea that the internet existed.

A breakthrough came in 2003 when a non-governmental organization called VVOB, a Belgian abbreviation which translates in English to "Flemish for technical assistance", came in to finance, train personnel, and equip the polytechnics with standard computer and network infrastructure (VVOB project document, 2003). The project procured standard desktops installed fibre cable for the internet, and set up Ethernet Local Area Networks (LANs) in polytechnic computer laboratories.

This project became the basis for mobile computing in Zimbabwe Polytechnics. When the project ended in 2008, it left the institutions at the same level in terms of ICTs and with the necessary backbone to expand and embrace future technological developments, such as mobile computing. This research sought to investigate the adoption and

implementation of mobile computing at Gweru Polytechnic. A survey was mainly conducted using a questionnaire as the main data source. Literature was, however, used as a guide to trends in mobile computing in higher education institutions globally.

This research sought to determine the hardware and software systems used by administrative staff, academic staff, and students at Gweru and Kwekwe Polytechnics. It explored how they were being used as well as the achievements and associated benefits realized from the use of mobile computing. The study also sought to highlight the challenges faced by the institution and ways of mitigating them. Finally, this research intended to identify opportunities the polytechnic can exploit if it fully embraced mobile computing.

Significance of the study

While academic institutions have used and benefited immensely from ICT in teaching and learning, the bulk of the teaching remains fixed in the classrooms. Technical and Vocational Education institutions need to adjust and implement mobile learning. The research ascertains the existing ICT infrastructure and systems for mobile computing and establishes the gaps that need to be filled. The findings from the research help in the construction of ICT policy on training. It will also help in making a Technical and Vocational education curriculum that embraces mobile learning.

Research Questions

1. What are mobile computing devices and applications used in polytechnics?
2. What are the challenges in the implementation of mobile computing to support teaching and learning?
3. What are lecturers' attitudes and perceptions about incorporating mobile learning in their classrooms?

Literature review

According to Tarun et al. (2013), Mobile Computing is a technology that permits the transmission of data, using a computer, without having to be associated with a physical connection. Mobile voice communication is widely used throughout the world and has had an exceptionally quick increment in the number of subscribers to the different cellular networks over the last few years. An extension of this technology is the capacity to send and get information over these cellular networks.

Kumawat et al (2013) further affirm that mobile data communication has turned into a vital and quickly developing innovation as it permits users to transmit information from remote areas to other remote or fixed areas. This turns out to be the solution for the most serious issue of businesspeople moving - mobility. Mobile computing encourages interaction through smooth innovation whereby clients sense and control what straightforwardly intrigues them while holding tangential attention to other enlightening open doors that they can whenever decide to concentrate on. This requires consistent access to media, data sharing, and communication through heterogeneous systems, which are distributed and may be profoundly embedded in the physical environment.

According to Tarun et al (2013), mobile computing alludes to the infrastructure put in place to guarantee that consistent and dependable communication goes on. These would incorporate things such as applications, Protocols, Services, Bandwidth, and Portals necessary to facilitate and backing of the stated systems. This guarantees that there is no collision with other existing networks which offer the same service. Since the media is unguided, the overlaying structure is more radio wave-oriented. That is, the signals are carried over the air to intended gadgets that are capable of receiving and sending the same sorts of signals.

Karim and Goodwin (2013) are of the view that mobile devices incorporate cell phones or gadget segments that get or access the administration of mobility. They would extend from portable workstations, Smartphones, Tablet Computers, and Personal Digital

Assistants. These gadgets will have receptor mediums that are fit for sending and accepting signs. These gadgets are designed to work in full-duplex, whereby they are fit for sending and receiving signals at the same time. They don't need to hold up until one gadget has completed the process of conveying for the other gadget to start communications. The mobile devices specified utilize an existing and built-up network to work on. By and large, it would be a wireless network.

Karim and Goodwin (2013) stated that mobile software refers to the actual programs that run on mobile hardware. It manages the characteristics and necessities of mobile applications. This is the brain of that mobile device. In other terms, it is the working arrangement of that device. It's the fundamental segment that makes the mobile device work. In today's registering world, diverse advances have come up. These have developed to bolster existing computer organizations everywhere throughout the world. With mobile communication, we discover that being bound to one physical area has been eliminated. This new technology enables users to update documents, surf the internet, send and receive an e-mail, stream live video files, take photographs, and support video and voice conferencing.

The development of convenient computers and tablets, individual computerized Assistants (PDA), PC Tablets, and Smartphones, has thusly made mobile computing very convenient. The portability of the gadgets guarantees and empowers users to get to all services as though they were in the internal system of their organization; for example, the utilization of Tablet PC and iPad. This new technology empowers clients to upgrade records, surf the web, send and get an email, stream live videos, take photos furthermore bolster video and voice conferencing (Karim and Goodwin, 2013).

According to Hwang et al (2014), the term M-Learning or “Mobile Learning" has different meanings for different authorities, that refer to a subset of E-Learning, educational technology, and distance education, that focuses on learning across contexts and

learning with mobile devices. Mobile learning has many different definitions and is known by many different names, like personalized learning, learning while mobile, ubiquitous learning, anytime/anywhere learning, and handheld learning.

Another meaning of mobile learning is, "any sort of learning that happens when the learner is not at a fixed, foreordained area, or discovering that happens when the learner takes advantage of the learning opportunities offered by mobile technology" (MOBIlearn, 2003). As such, with the utilization of cell phones, learners can learn anyplace and whenever (Crescente and Lee, 2011). Portable learning will be the capacity to use mobile gadgets to bolster learning.

Mobile learning is certainly not only the conjunction of “mobile” and “learning”; it has always implicitly meant ‘mobile E-Learning’ and its history and development must be understood as both a continuation of ‘conventional ‘, E-Learning and a reaction to this ‘conventional’ E-Learning and its perceived inadequacies and limitations. It will be the “portable” viewpoint of mobile learning that makes it stand separated from different sorts of learning, specifically designing learning experiences that exploit the opportunities that ‘mobility’ can offer us (Hwang et al, 2014).

M-Learning focuses on the mobility of the learner, connecting with portable technologies, learning that reflects a focus on how society and its institutions can accommodate and support an increasingly mobile population. This is because mobile devices have components and usefulness for supporting learners. For instance, podcasts of lectures can be made accessible for downloading. Learners are to hope to connect with these advanced tools whilst away from the conventional learning locations. Over the past ten years, mobile learning has grown from a minor research interest to a set of significant projects in schools, workplaces, museums, cities, and rural areas around the world. The M-Learning community is still fragmented, with different national perspectives, differences

between academia and industry, and between the school, higher education, and lifelong learning sectors, (Singh, 2010).

Mobile learning helps students to learn and comprehend at an exceptionally fast rate where their gaps may exist. E-learning permits lecturers to convey learning material efficiently and rapidly into the hands of students with a consistency we've never possessed the capacity to have. The technology permits administrators to track and see whether the learning material is in the hands of the staff, and also the online testing gives quick results. It is noticed that e-learning has made more prominent adaptability and control that regularly bear the cost of learners to get knowledge (Cocoa and Charlier, 2013).

As indicated by Monika (2013), e-learning in the corporate training world is expanding quickly because of the time and spending plan effectiveness in course advancement and conveyance. Numerous authors like McGill, Klobas, and Renzi (2014) have cited that, given the issues identifying with money-related backing, the least positioned condition identified with the activity is being financially beneficial for e-learning. The studies from Joshi, Subrahmanyam, and Anvekar (2014) say that m-learning control costs, increase quality, more qualified for geographically differing representatives, give more predictable course conveyance, and render more individual guidelines and regard for the learners by modernizing the work power. Accessibility of training to a broad audience, sophisticated tracking features that can record individual training performance for training administration, self-directed learning, instructional elements including practice, immediate applicability, quicker and consistent access to the employees, and feedback that can be easily accomplished without interaction with a live instructor are some of the great features of e-learning.

Karim and Goodwin (2013) argue that, as learning management systems adapt to the mobile platform, m-learning may become a common tool for exploration by tech-savvy

faculty. The use of mobile devices seems a natural fit for distributed learning and field activities in that handheld technology can not only accompany the learner almost anywhere but also provide a platform that is rapidly evolving and always connected to data. Learning management frameworks may drive grounds to perceive the capability of this always-on, anywhere technology that brings down the physical limits to learning and expands the classroom. Usability offered by mobile devices underpins long-lasting learning, and because the gadgets themselves are part of everyday life, they encourage credible learning. Eventually, it may be the universality of these students' possessed devices that guarantees their use as teaching and learning tools. The rising prominence of mobile devices ought to advance the improvement of cloud-based applications that support different devices.

Srivastava and Agarwal (2013) cited that hardware for mobile learning represents a wide range of platforms, screen sizes, and functionality, and no clear standards exist for development that addresses all of the tools available. As a result, colleges and universities can find infrastructure issues tricky to resolve. The cost of smartphones and data plans is out of reach for some students, and adoption and ownership are uneven. While the screen size on many mobile devices enforces simplicity of design, the small screens and keys are difficult for some to use effectively, and the additional strain on battery life imposed by mobile apps can be frustrating. Because m-learning is an emerging market, there remains a dearth of applications designed specifically for learning, and repurposing existing lesson materials for the mobile platform might add to the faculty workload. The extensive mix of devices and mobile formats, which are generally subject to student and faculty choice, could delay m-learning development, and standards may be slow to emerge in an environment where manufacturers are often trying to decide whether to merge their mobile devices with slates, tablets, or e-readers. Furthermore, while the devices can go anywhere with students, they might not engage students for long periods, as mobile learning activities are subject to frequent interruptions, Srivastava and Agarwal (2013).

Methodology

This research was a case study at two polytechnics i.e., Gweru Polytechnic and Kwekwe Polytechnic in Zimbabwe. The researchers designed a questionnaire and an interview guide which were used to solicit data. Both qualitative and quantitative research approaches were used since both approaches gave the advantage of improving on evaluation by ensuring that the limitations of one type of data are balanced by the strengths of another. The random sampling technique was used to select 50 respondents, that is students and staff from the two polytechnics. A general observation was done to verify information obtained through the questionnaires and interviews.

Research findings

a. Lecturers' access to the internet

According to Kumawat et al (2013), connectivity on mobile devices is a major challenge in mobile computing. The issue of internet connectivity can greatly disturb the implementation of mobile learning. The researchers found out that 58.2% of the lecturers in the survey had internet connectivity though it was not consistent while 30.9% indicated that they had a very reliable internet connection. However, a significant 10.9% of the respondents had serious challenges with internet connectivity shown by indicating 'No' on the questionnaire.

b. Mobile devices used

Karim and Goodwin (2013) are of the view that mobile devices incorporate cell phones or gadget segments that get or access the administration of mobility. They would extend from portable workstations, Smartphones, I-pad, Tablet Computers, and Personal Digital Assistants. These gadgets will have receptor mediums that are fit for sending and accepting signs. The researchers found out that the majority of the staff and students at the polytechnics use laptops (84%). All the respondents indicated that they used either a smartphone (56.4%) or an Ipad (20%) or a tablet (42%).

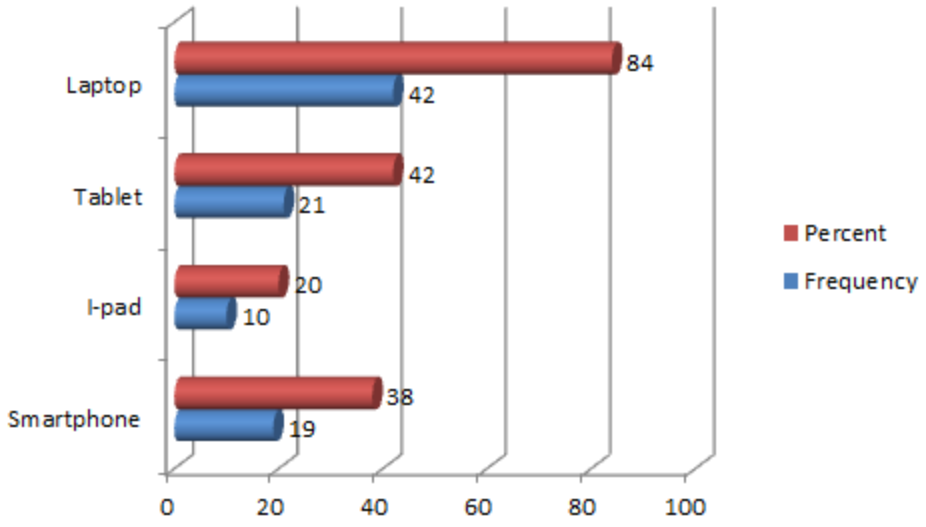

Figure 1: Devices used

3. Lecturers' perceptions of mobile learning

Table 1 shows the opinions of the lecturers on the use of mobile learning. The findings show that lecturers generally agreed that mobile learning disseminates information quickly (80%), and the idea that mobile learning makes it easier for lecturers to carry out teaching duties also got much support (75%). The majority of the lecturers did not agree with the idea that students would participate more in class if they use mobile devices (25% agreed) and also the respondents did not agree that students would spend more time on classwork when using mobile devices (25% agreed). The most common theme from lecturers' responses indicated that the lecturers that responded have a mostly negative view of mobile device use in the classroom. Still, many lecturers see the potential for using mobile devices in the classroom as a supplement to current methods and believe that course materials should be easily accessible via mobile devices.

Table 1: **Lecturers' perceptions of mobile learning**

	Agree		**Disagree**	
	No. of Responses	**Percentage**	**No. of Responses**	**Percentage**
Mobile learning disseminates information quickly.	16	80%	4	20%
Mobile learning makes it easier for lecturers to carry out teaching duties.	15	75%	5	25%
It's easy for lecturers to use mobile learning.	15	75%	5	25%
Data on mobile networks is expensive	16	80%	4	20%
Students participate more in class	5	25%	15	75%
Students spend more time on classwork	5	25%	15	75%
Mobile devices cost is expensive.	11	55%	9	45%

4. How many of your lecturers use mobile learning?

40.3% of the students reported that a few polytechnic lecturers use mobile learning and 20.8% of the respondents indicated that none of their lecturers use mobile learning. Only 6.5% of the respondents indicated that all their lecturers use mobile learning.

5. Challenges faced using mobile communication devices for learning

This research revealed the following as challenges the institution is facing in trying to improve mobile computing: -

- Limited financial resources to move with mobile technology trends
- Inconsistent internet connectivity, low bandwidth, and congestion
- Electricity outages, since low battery life devices are used by the majority, which require constant battery recharge.
- Expensive data for mobile telephone operators
- Lecturers upload little content

6. Achievements

The following were identified as achievements made by the institution in trying to promote mobile computing: -

- The installation of wireless access points to enable access to LAN and the internet through mobile devices.
- Procurement of laptops for staff.
- Increasing internet bandwidth from 10Mbps to 20Mbps.
- Engaging in public-private partnerships with a mobile operator to provide additional wireless interconnectivity.
- ICT skills upgrading for staff.
- Installation of the website, webmail, and eLearning software.

Discussion

Although students are currently performing educational tasks informally, the data implies that students believe that more formal incorporation of mobile learning would be beneficial and effortless. The data indicates that lecturers, however, would most likely limit the incorporation of learning opportunities and access to course materials outside the classroom as the data reveals that they do not think participation and engagement would increase with in-class use and they do not prefer mobile devices be used for in-class activities. More prevalent, however, was the use of the device for accessing information and course materials via the web. Although most students were able to access the Internet through their devices, students and lecturers agreed that course materials and learning management systems should be more accessible and easily viewable in a mobile format from devices.

The data also reveals that students are aware of how the use of mobile devices could impact their motivation to learn. Students believe that they would be more likely to participate and engage in-class activities and discussions both inside and outside of class if they could use their mobile devices. The Technology Acceptance Model is a theory that suggests that two main factors, perceived use, and ease of use, influence a user's decision about how and when they will use a technology (Davis, 1989). In this study, survey items were designed to measure students' and lecturers' perceptions about perceived use and ease of use to understand if students and/or Lecturers were willing to adopt the use of mobile devices for learning.

Results from the analysis of the survey items suggest that students may be more ready to fully adopt mobile technology for learning than lecturers. Age and experience, as suggested by some researchers, may be the reason for this difference. Prensky (2001) proposes that there is a distinct difference between "digital natives" and "digital immigrants" in the way they view and use technology. Digital natives, students who have been exposed to and immersed in technology since birth, will likely perceive the use of technology very differently than digital immigrants, in this case, most of the Lecturers members.

This study revealed that students were more open to using mobile devices for learning while Lecturers were concerned with potential distractions. Students and lecturers both agreed that students would be able to learn how to use devices for learning with ease, but admitted they would need additional training. As digital natives, students may have more knowledge of the capabilities of mobile devices than lecturers.

Recommendations

Based on the results of this study, the following suggestions are offered to support the effective use of mobile technology in learning at polytechnics in Zimbabwe:

1. Increased lecturers, and training regarding the capabilities of mobile technology and its potential use in the classroom including applications that are available via smartphone stores and textbook companies.
2. Updates to the colleges' websites and learning management systems that allow them to be viewed in a mobile format.
3. Resource page on the college website with recommendations for mobile applications that may apply to students and lecturers.
4. Increased dialogue among students and lecturers, lecturers and lecturers, and lecturers and administrators about the learning opportunities available through mobile devices.
5. Formation of a partnership with a mobile network that reduces the cost of a device and/or data plan for students and lecturers.
6. Collaboration between the polytechnics and either the Information Technology departments or an outside resource that could develop course-specific mobile applications that could be used for general education courses.

References

Chen, B., and Denoyelles, A. (2015) *Exploring students' mobile learning practices in higher education*. RetrievedNovember11,2015, http://www.educause.edu/node/54998.

Crescente, M. and Lee, D (2011). *"Critical issues of M-Learning: design models, adoption processes, and future trends"*. Journal of the Chinese Institute of Industrial Engineers 28 (2): 111–123.

Cole, H., and Stanton, D. (2011) *Designing Mobile Technologies to Support Co-Present Collaboration. Personal and Ubiquitous Computing*, 7, Springer Verlag London Ltd.

Clarke, P., Keing, C., Lam, P. and McNaught, C. (2008). *Using SMSs to Engage Students in Language Learning. In Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2008* (pp. 6132-6141). Chesapeake, VA: AACE.

Colley, J. and Stead, G. (2004). *'Take a bite: producing accessible learning materials for mobile devices*, Proceedings of MLEARN 2003: *Learning with Mobile Devices. London, UK: Learning and Skills.*

Compeau D., Higgins C.A., and Huff, S. *(1999) Social cognitive theory and individual reactions to computer technology: A longitudinal study*. MIS Quarterly 23:145–158.

Corbeil, J.R., & Valdes-Corbeil, M.E. (2007). *Are you ready for mobile learning?* EDUCAUSE

Quarterly. No.2, 2007. Retrieved on July 2015, from http://www.educause.edu /ir/library/pdf/EQM0726.pdf

Creswell, J. W. (2002). Educational research: *Planning, conducting, and evaluating quantitative and qualitative approaches to research.* Upper Saddle River, NJ: Merrill/Pearson Education.

Davis, F. D. (2012). *Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly*, 13(3), 319-340. Development Agency, 43-46

Dieterle, E., Dede, C., & Schrier, K. (2007). "*Neomillenial" learning styles are propagated by wireless handheld devices.* In M. Lytras and A. Naeve (Eds.), Ubiquitous and pervasive knowledge and learning management: Semantics, social networking, and new media to their full potential. Hershey, PA: Idea Group, Inc.

Doneva, R., Nikolaj, K., and Totkov, G. Towards mobile university campuses. International Conference on Computer Systems and Technologies (CompSysTech'2006). Retrieved April 2016 from http://ecet.ecs.ru.acad.bg/cst06/Docs/cp/sIV/IV.3.pdf

Engestrom, Y. (2013). Learning by expanding: An activity –theoretical approach to developmental research. Helsinki: Orienta-Konsultit.

Fetaji, M. (2008). Literature Review of M-Learning Issues, M-Learning Projects, and Technologies. In C. Bonk et. al (Eds.), Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2008 (pp. 348-353).