

Enhancing Mobile and Ubiquitous Learning of Cyber Security Concepts

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Abstract

Amidst precarious socio-political circumstances, information security is paramount, since saying the wrong thing in the wrong context can turn one into a political enemy. In addition, where such circumstances affect educational institutions, mobile, ubiquitous teaching and learning becomes a safe heaven for Universities. This paper explores how the learning of cyber security concepts have been enhanced through mobile and ubiquitous learning methods. By collecting qualitative data from cyber security majors in an African University, the study found that students' appreciation of concepts such as operationalization of the cyber security triad, understanding and identifying of security threats, Hardening techniques as well as security awareness was greatly influenced by their learning context. However, it was perceived that there is little or no connection between their cybersecurity knowledge and the experience they faced. The paper concludes by recommending ways in which ubiquitous learning could be better leveraged for the African context.

Keywords: Ubiquitous and Mobile learning, Cyber security Concepts, African University

I. Introduction

The on-going socio-political crisis facing the South-West and North-West regions of Cameroon has resulted to serious instability in these parts of the country. This crisis is termed “Anglophone crisis” due to the geographical and linguistic nature of these two regions. Cameroon originating from a British and French trusted territories have strived to integrate the political, judicial and educational inheritance from both colonial masters. English Cameroonians occupying one fifth of the national territory have always felt marginalized and looking for a means to express their grievances. This began with strikes by Anglophone lawyers and teachers in protest of the erosion of their educational and legal systems inherited from British colonial rule in favor of the educational and legal systems used in the French regions. In a bid to manage information exchange through social media between the frustrated Anglophones at home and abroad and the risk social media communication can bring forth, the Government ordered for an internet shutdown in these parts of the country from January 17th to April 20th 2017 (Nyinkeu et al., 2018).

The consequences of this action led to the radicalisation of some protesters resulting to an armed conflict with the Government defense forces. There was therefore, a high rate of insecurity with daily kidnapping of inhabitants including students, teachers and religious leaders. Parents and guardians worried about this alarming situation encouraged their children to stay home to reduce the probability of being kidnapped or being caught in gunshots exchange between protesters and government defense forces. In an attempt to ensure continuous learning and education even during this period of political instability, schools in these regions devised new strategies notably, the creation of remote campus sites in the French speaking regions taking into consideration that most students’ families reside or live in these regions. This is the case with the Catholic University Institute of Buea, an institution of higher learning located in Buea, South West Region of Cameroon that opened remote campuses in Douala and Yaounde to ensure students’ continuous education.

With the present student/faculty ratio, the usual classroom work has been brought closer to the students. This has been done by creating Social media groups on WhatsApp, Google classroom, Youtube amongst others for different courses especially taking into consideration that every student in the university has one or more smart devices like smartphones and tablets. In this way, faculties were recording video lectures and uploading them on those platforms for students to download on their mobile platforms, faculties engaging students through group discussions, faculties posting homeworks and projects to be done and students posting their concerns and issues faced on those platforms. For cybersecurity students in particular, this was a huge paradigm shift especially for those in their senior year who have been used to in the past 3 years of their educational journey to traditional methods of teaching and learning. Determining the influence of mobile and ubiquitous learning methods in students’ understanding and operationalization of cyber security concepts is the main objective of this research. This study

carried out on cyber security students at the Catholic University Institute of Buea, Cameroon is a qualitative study using semi-structured interviews to gather rich data that will be analysed to draw conclusions in the present context. The main objective of this study can be attained by the following specific objectives:

- Evaluate the effects of mobile and ubiquitous learning in students in a situation of political instability and insecurity
- Determine the cybersecurity concepts reinforced in students learning using mobile devices and social media

II. Literature Review

Information and communication technologies (ICTs) are taking on an ever greater prominence in education. Many governments are emphasising the need to turn out digitally literate, technologically able graduates who are employable in the global information economy (Buchanan, 2011). Many educators, by contrast, emphasise the creative, student-centred pedagogical approaches facilitated by digital tools, while others stress the role of online communication and collaboration in creating well-informed and well connected global citizens (Pegrum, 2009). Mobile learning, or m-learning, is perhaps the fastest growth area in the whole field of ICTs in education. It covers any form of learning that is mediated through a mobile or, more precisely, mobile handheld, device. These devices encompass digital media players (including iPods and iPod Touches), smartphones (including iPhones, Android phones, BlackBerrys and Windows phones), personal digital assistants (PDAs), and tablet computers (including iPads) (Pegrum et al., 2013). According to Birgit Bomsdorf, ubiquitous or mobile learning is the next step in performing e-learning and by some groups it is expected to lead to an educational paradigm shift, or at least, to new ways of learning. The potential of ubiquitous learning results from the enhanced possibilities of accessing learning content and computer-supported collaborative learning environments at the right time, at the right place, and in the right form. Furthermore, it enables seamless combination of virtual environments and physical spaces (Bomsdorf, 2005). Reports like Prometheus support the view above by describing ubiquitous learning as a learning activity not constrained by schedules and physical spaces; rather, it is pervasive and ongoing, prevalent in many interactions among students, faculty, parents, administration, staff, a wide variety of community stakeholders (Prometheus, 2001). Ubiquitous learning is characterised by the following factors (Ogata, H.; Yin, C.; Yano, Y.: referencing Chen et al., 2002; Curtis et al., 2002):

- **Permanency:** Learners can never lose their work unless it is purposefully deleted. In addition, all the learning processes are recorded continuously everyday.

- Accessibility: Learners have access to their documents, data, or videos from anywhere. That information is provided based on their requests. Therefore, the learning involved is self-directed.
- Immediacy: Wherever learners are, they can get any information immediately. Therefore learners can solve problems quickly. Otherwise, the learner may record the questions and look for the answer later.
- Interactivity: Learners can interact with experts, teachers, or peers in the form of synchronous or asynchronous communication. Hence, the experts are more reachable and the knowledge is more available.
- Situating of instructional activities: The learning could be embedded in our daily life. The problems encountered as well as the knowledge required are all presented in their natural and authentic forms. It helps learners to notice the features of problem situations that make particular actions relevant.
- Adaptability: Learners can get the right information at the right place in the right way.

As stated in the above characteristics, adaptation of learning environments for ubiquitous and mobile learning is challenging and is indispensable to ensure effective knowledge transfer to students. This is supported by Fischer's view where he points out that the challenge is not only to make information available to people at any time, at any place, and in any form, but specifically to say the right thing at the right time in the right way (Fischer, 2001). Some approaches to adaptation of learning spaces include; ubiquitous web applications which involves adaptation not only to different kinds of devices such as smartphones, tablets or laptops, but also to network, location and time ((Kappel et al. 2002); adaptation of user interfaces dealing with adaptation of the content presented in each page and with changing the appearance of visible links according to the student model (Brusilovsky & Peylo 2003). In addition, adaptation of the user interface has to be of special interest since this is the part by which a digital learning space is accessed. In general, usability is a key factor for acceptance of an interactive system, and thus for educational systems. The results of different studies document the importance of usability for a successful learning process (which is not astonishing from the view of usability engineering and related fields). With the spreading use of mobile devices, adaptation of the user interface to support multiple platforms is again challenging in UI development (Bomsdorf, 2005).

A number of studies were performed to better understand and measure students' attitudes and perceptions towards the effectiveness of mobile and ubiquitous learning with a notable one carried out at King Saud University, Saudi Arabia. This study was a survey of one hundred eighty six (186) undergraduate female students to determine how this technology can be optimally used to improve student retention at Bachelor of Art and Medicine programmed at King Saud University in Saudi Arabia. Result of this survey indicated that offering mobile learning could be a method for improving retention of B.A ,and M.D. students, by enhancing their teaching/learning. Added to the above, students pointed out as biggest advantage of this technology the fact that it can be used anywhere, anytime and adopt their mobile learning systems with the aim of improving communication and enriching their learning experiences in their open and distance learning (Al-Fahad, 2009). Another comparable study was done in ten Western Australian independent schools on the adoption of mobile handheld technologies where mobile learning was still at an experimental stage in most schools. This study revealed that mobile devices were seen as enhancing student motivation, with empirical evidence of improved student learning also emerging in small-scale studies conducted by two schools. Challenges included the need to carefully manage the technology, ethical issues in its use, and staff roles in its deployment (Pegrum et al., 2013).

Below are the research questions guiding this study:

1. What are the effects of mobile and ubiquitous learning in students' in a situation of insecurity and socio-political instability?
2. What cyber security concepts are operationalized and reinforced in students through mobile and ubiquitous learning?

III. Methods

III.1 Participants

The participants in this research are students of the department of Cyber Security, School of Information Technology (SIT) of the Catholic University Institute of Buea (CUIB), Cameroon; from freshman year to the senior year coupled with the associate degree students in the field of Information security. The selection was based on the fact that they are the ones who are more involved in the usage of the cyberspace coupled with their knowledge and understanding of the threats/risks that are involved there in. This was done voluntarily by the students as which we did insured by setting up a platform while informing them to go there and perform the interview by answering the questions.

For this, there was a total of **16** participants, **75%** of which are males while **25%** of the rest of the said population were females. The participants ages range from **18** to **27** years old, with the dominant ages of **21** years old followed by **20** years old. The most active class level that fully

partake in the interview were the senior year students with a percentage of **37.5%** while the less active level were the Junior year students of a percentage of **12.5%**.

III.2 Procedures:

The findings was done in a former manner where all the students were informed through their different level school whatsApps groups under the knowledge and permission of the Dean of the school of IT, for them to follow the created link on Google Doc to answer the interview questions. The interview questions were made available for a period of over one week at the convenience of the participants. Though they could answer at anytime over this one week period of time, their individual responses could be seen individually or as a group.

IV. Results

Data analysis and interpretation was done concurrently to maintain a close relation between the analytic discuss and the inferences drawn from these analysis. The findings have been tallied around the two research questions stated above, based on their appropriateness to the question and also to facilitate interpretation. Here we will be taking a closer look at the findings we had from the students and also doing some interpretations of the findings.

RQ1: *What are the effects of mobile and ubiquitous learning in students in a situation of insecurity and socio-political instability?*

On a general note, students expressed their satisfaction to continue with their studies even in a period of political instability. They were really appreciative of the fact that the University administration could find ways to ensure their continuous education. The excerpts below are from two students who feel really appreciative of this form of learning.

“It was quite a good experience since the insecurity warrants one to be at home and we could keep track or in touch with our lecturers via these platforms and remain safe.”

“It was a great experience, it helped us to study round the clock, anytime you faced any difficulties just send online and always we have classes daily despite the ghost towns”

Others had a mixed feeling about studying using mobile phones and social media used to deliver lectures because they had to face distractions from repetitive text messaging and personal activities on these social media, therefore making it difficult to focus during lecture or study time. The excerpt below illustrates the above assertion.

“Using WhatsApp, it was a distraction especially when I have a class and receiving text messages”

Others raised the problem of network and internet connectivity that hindered them to have seamless classes therefore had to devise new ways in order to reduce their daily internet consumption. Below are excerpts of two students illustrating this issue.

“Network problem is the most frequent problem I face because the lines at times keep on breaking and at times the voice of the lecturer isn't clear. Also online classes are very expensive”

“I had difficulties in understanding the teacher when he tried using Google classroom in teaching and so to solve that problem, we upgraded to WhatsApp and Zoom which provided us with both audio and video interfaces. Also due to the fact that all the platforms used mobile data, getting data was a huge problem since I am just a student who relies on a monthly allowance and does not work. My solution to this was to minimize my data usage just for educational purpose foregoing other extra consumption”

RQ2: *What cyber security concepts are operationalized and reinforced in students through mobile and ubiquitous learning?*

The findings reveal that important cyber security concepts have been enhanced and reinforced in when studying with mobile devices and social media in a situation of political instability. Chiefly, the understanding and identification of security attacks and threats that may affect studying using mobile devices mainly phishing attempts, hacking and identity theft. The excerpts below demonstrate students' understanding of these concepts.

“Students could easily be misguided by some individuals who take unauthorized control of their tutors account”.

“Your personal data is at risk, ID theft is possible therefore your reputation as an individual is also at risk”.

Cyber criminals may use phishing methods to get valuable information online and can also send fake links which one may unknowingly click on it”.

Some students were able to make a connection on how the objectives of the cyber security triad that is, confidentiality, integrity and availability can be breached when learning using mobile devices and social media. One student said:

“ Some notes sent can be intercepted and modified before it reaches us”

Despite all the security ramifications learning using mobile devices can bring forth, students could identify some hardening techniques that could make the learning experience more secured and reliable. This is illustrated by the following excerpt.

“We should create our own App, and means of security that will be built in the app, making our information or notes not readable for an unauthorized user”

Finally, some students could relate common security best practices to make users feel more secure when using mobile devices for educational purposes. The extracts from 2 students below illustrate these best practices commonly taught during security awareness trainings.

“Install anti-virus/anti-malware systems on your mobile devices. Check to see if the website you are visiting always has the https on and not http. When your device warns you about a tool not being from a secure source, don't forcefully download and install it”

“Users should have or be able to patch, update and run anti-viruses on their mobile devices. Have a good password to prevent easy access”.

In a nutshell, 4 cybersecurity concepts are reinforced and operationalized in students while learning through mobile devices and social media:

1. Understanding and identification of security attacks and threats
2. Operationalization of the objectives of the security triad
3. Hardening techniques
4. Security best practices for user's awareness

However, it was perceived during this study that some students had little or no connection between cyber security knowledge and the experience faced. This is mostly seen as students could only give textbook answers when asked to give ways these platforms can be improved for better learning and possible security vulnerabilities. The reflections in italics below demonstrate this perception.

“It [platform] may face a man-in-a-middle attack”

“There should be end to end encryption of data shared between the lecturers and students”

V. Conclusion and Recommendations

The socio-political instability encouraged this educational institution to adopt a new way of learning and teaching never experienced which had mixed feelings by the students. The majority of the students believe that the teaching and learning of cybersecurity as a body of knowledge is made difficult using mobile devices and social media when theoretical knowledge acquired is not translated in a practical manner through traditional approaches such as lab exercises and game-based learning. The excerpt below illustrates this.

“In my opinion courses that involve the transfer of technical knowledge should not be taught using some of this platform(google classroom) when there is instability, zoom is a better option but on-site delivery would be the best option for studying and learning cyber security”

This puts into question the adaptation of learning environments to enhance better student's experience. The University in this case didn't foresee the setup of an adequate mobile learning platform that will help students have a seamless transition from traditional classroom settings to mobile learning that will take into consideration the complexities of cyber security body of knowledge and mobile learning most importantly experiential learning, the availability of affordable and reliable internet connectivity and also leveraging the high level of penetration of mobile devices amongst African students. One student said:

“They [platforms] should be incorporated with the necessary tools needed to teach student e.g. if we are doing a course like python the IDE should be incorporated within the platform”

Ubiquitous and mobile learning is as educational method that has come to stay and can be leveraged in African Universities to teach and learn cyber security. We recommend the following ways:

1. Develop reliable, affordable and easy to use mobile learning platforms that could minimize the consumption of Internet or data connection by students mobile devices
2. Integrate tools necessary for students to carry out with lab exercises within the platforms
3. Setup strong and long-ranged wireless networks in University campuses that students can connect to using their mobile devices to reduce their mobile data consumption

The study is limited by its context and methodological approach and as such generalizations would be premature. The study was carried out in Cameroon – Africa ,during a period of political instability and insecurity in two out of ten regions in the country. It focuses on the first four cohorts of students from a private university, in a Bachelor's Degree program in Cyber Security. However, it offers a unique experience from which other researchers and educators could draw inspiration. The impending limitation of small sample and uniqueness, informs the methodological stand for the study

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