Feasibility Assessment on the Implementation of M-Learning at Universidad Politecnica Salesiana at Guayaquil

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Keywords– mobile learning, digital repositories, mobile apps, higher education

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Resumen- La presente investigación parte de un estudio realizado sobre hábitos de lectura en los estudiantes de Universidad Politécnica Salesiana del Ecuador, sede Guayaquil. Los resultados mostraron que las preferencias por la lectura y utilización de la biblioteca universitaria quedan por debajo de la media encuestada. Antecedentes que provocaron identificar las nuevas formas y espacios concebidos para la lectura en los estudiantes universitarios. En este contexto, el objetivo de este artículo es evaluar la viabilidad de adoptar dispositivos móviles dentro de las metodologías de enseñanza y aprendizaje de esta universidad. Se aplicó la técnica de la observación simple y se efectuaron focus groups con alumnos de diferentes niveles de estudio y carreras, donde se evidenció la creciente preferencia por los dispositivos móviles y el reconocimiento de las facilidades de su uso en el proceso de enseñanza-aprendizaje. Basado en las experiencias de otras instituciones en la utilización de aplicaciones telefónicas con fines académicos, y los resultados del focus group se realiza un estudio de factibilidad para la implementación de propuestas de m-learning que permitan el fácil acceso desde dispositivos móviles al repositorio digital de la universidad como fuente de lectura académica.

Palabras claves– mobile learning, repositorios digitales, aplicaciones móviles, educación superior.

Résumé- Cette recherche tien son origine dans une étude fait sur les habitudes de lecture des étudiants de l'Universidad Politécnica Salesiana del Ecuador, filière Guayaquil. Les résultats ont montré que les préférences pour la lecture et

l´utilisation de la bibliothèque universitaire se trouvent dessous la moyenne enquêtée. Les arguments précédents ont permis de mettre en avant les choix des étudiants universitaires. Dans ce contexte, l´objectif de cet article est évaluer la faisabilité de l´utilisation des dispositifs mobiles dans les méthodologies d´enseignement et d´apprentissage de cette université. On a appliqué la technique de l´observation simple et on a fait des focus groups avec des étudiants de différents carriers et de niveau d´étude. Les résultats reflètent la préférence pour les dispositifs mobiles dans les processus d´apprentissage. Sur la base d´expériences réalisées dans d'autres institutions d´éducation supérieure dans l´utilisation de mobile, et les résultats des focus group, se propose une étude de faisabilité pour appliquer m-learning en facilitant l´accès à la bibliothèque digitale de l´université.

Mots clés– mobile learning, bibliothèque digitale, utiles mobiles, éducation supérieure

I. INTRODUCTION

Nowadays, the strengthening of the Information and Communications Technologies (ICT) has conveyed people to find ways to get involved and, despite different limitations, to own devices for access to these technologies. The varied levels of education are not indifferent to this reality, being the reason educative bodies are increasingly embracing computational and virtual tools to innovate their educational methodology, even from a critic perspective of their use [1]. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) [2], the current problem is not to incorporate technology into the educational environment, what has been snobbishly done lately, but how to use it to improve the teaching and learning processes.

The higher education merits constant innovation, but also the adaptation to the new students' demand and to the immediate framework where it develops. This work proposes a feasibility assessment for the adoption of mobile learning (m-learning) as a tool in the teaching and learning processes at Universidad Politecnica Salesiana (UPS). Specifically, it will consider the outcomes of the survey applied to undergraduate students on reading habits and the use of UPS the library. In addition, the findings after the analysis of four focus groups, comprising students from majors in Social Communication and Electrical Engineering, on reading habits and preferences will be considered as well. Finally, it will analyze the viability of

developing a mobile app for direct access to the library online catalog so the students have a reliable primary source of information.

II. Background

Virtual education allows people to work, learn and study whenever it is suitable for them, and considering the dissimilar opportunities offered on the internet, it conveys to rethink the higher education teaching process [3]. The universities face the need of innovating pedagogical methods if they want to be attractive and inspirational to the new generations of students[2].

Since the appearance of the first smartphone with internet access in the year 1999 in Japan, the use of this device has raised exponentially, what lead the mobile technology to quickly become an essential part of daily life.

The m-learning is the inclusion of mobile devices, such as smartphones, tablets, laptops, among others, into the teaching and learning processes [4]. As a part of the education via the technology, it must ease learning and improve students' performance by means of creating, using and managing mobile processes and resources [5], [6]. Developed and developing countries with an advanced educational system are gradually integrating m-learning as a part of their teaching methodology; some authors remark that the m-learning is a form of e-learning, and hence, it is already an existent modality of learning [7].

Diverse studies present positive aspects related to m-learning as mobility, accessibility, interactivity and instant connectivity [8], [9]. The m-learning is a teaching and learning process that makes use of mobile technologies and occurs in different physical or virtual contexts [10]. These technologies encourage the user's freedom of mobility, instead of being and staying in a predetermined place to teach or learn. M-learning also constitutes a step towards the education from any location at any time.

For universities with a favorable increase of the students' demand but facing the absence of physical infrastructure, this learning system allows them soften their deficiencies. Other favorable aspect for the institutions embracing the most revolutionary teaching models nowadays is a higher position in the national and international educational rankings [11]. M-learning might be challenging for students and teachers at the very beginning because of the update and the adaptation to new educational models and technological advancements.

Despite the advantages of integrating m-learning in the educational model, it cannot be denied that this modality of teaching may lead, if the teachers do not have the support of an efficient monitoring system, to the misdemeanor and the diminishment of ethic among students, specifically the plagiarism. On another level, it is essential to know its limitations on laboratory experiments, practical courses with interaction or contact with human and animals and, art classes from majors like painting, theater, music, etc.

The social differences convey both technological disadvantages and the lack of enough connectivity to participate one hundred percent in this modality of studies, because only few students may afford the newest device models with higher capabilities and the cost of mobile data plans. Other negative aspect is the open access to any kind of information that will provoke an indiscriminate and irrelevant use of mobile devices by students during lectures. From some teachers' point of view, to learn and to apply this type of teaching add more obligations to their workload and take some of their personal time, creating an obstacle for them, their families and their professional performance [12].

In spite of some stances opposed to the usage of cellphones and tablets during lectures, arguing the excessive addiction of the new generations to these devices, it cannot be denied that there exist contexts conditioning, and sometimes even stimulating, the use of mobile devices in order to improve lectures.

III. Review of the m-learning implementation in developed countries

Since the appearance of the concept 'the knowledge society', discussed by Castell in 1996 [13], regions of the world with an outstanding educational system, as Japan, South Korea, Taiwan, United States of America, United Kingdom, and the European Union, have experienced challenges, including the product of updating the educational structure.

The evolution of the education is carrying out the use of mobile devices as a means for access to academic platforms and to send and receive information with academic purposes, by instance, smartphones are continuingly increasing their capacity and functionality until basically becoming portable minicomputers. The benefits encountered for the use of mobile devices by countries with first class education[14]–[18], indicate the easy integration of these devices into the educational system; however, in developing countries, like Ecuador, these benefits have not been disseminated, applied and far less exploited.

The main issues faced by developed countries are related to the telecommunications infrastructure, the inexistence of relevant software, the development of content and the financial support to promote the implementation of m-learning.

Khan et al [19] state that the implementation of m-learning in middle east countries is affected by five points: scope of adopting m-learning at a country level, interest in and awareness of integrating m-learning in teaching and learning, partnership between public and private entities, cultural standards and users' characteristics and behavior and, infrastructure for the deployment and performance of m-learning. The section 'lessons learned' shows a study of adversities faced by educationally advanced countries and the actions taken to overcome the five points mentioned earlier.

Nowadays, countries with a low level of development are analyzing, at different levels, the viability of implementing m-

learning in their educational systems, among these countries are Ghana[11], Nigeria[20] and Pakistan[21]. However, in Ecuador, no relevant researches on this topic are known, procrastinating possible updates and optimization of the education.

IV. TECHNOLOGICAL CONDITIONS OF ECUADOR

According to the Ecuadorian Agency for Regulation and Control of Telecommunications ARCOTEL [22], the amelioration of the cellular network infrastructure and the generalization of the use of mobile devices have provoked that 90.15% of the population has one active mobile line at least. On one hand the ownership of cellphones per Ecuadorian comprises the 55.4%, on the other hand the ownership of smartphones per Ecuadorian roughly comprises 18.81%[22], [23].

Other aspects to be considered are the price reduction of the mobile telephony plans that include data services, and the augmented free Wi-Fi coverage throughout the Ecuadorian territory.

The mobile data traffic presented an important growth, from 760 Terabytes in 2013 to 864 Terabytes in 2014, with a raising trend of 1,26 percent annually[24]. Both voice and SMS traffic tendency is declining because the data service is increasing. It is due to the usage of mobile data apps, that perform the same function as a voice call or a text message but, with no limitations because they are set up using the cloud. The user is able to choose how to use the capacity contracted in a wide variety of existing services, where to use it and, whether to use it or to switch over a Wi-Fi hotspot if available.

E-learning is a part of the modern educative methodology in most of the Ecuadorian universities. However, even though Ecuador's Good Living Plan contemplate the incorporation of new technologies in the education and its optimization, the national government has not set out initiatives nor proposed incentives for the improvement of e-learning and the inclusion of m-learning in the teaching methodology of local universities.

V. FEASIBILITY ASSESSMENT OF M-LEARNING IMPLEMENTATION IN UPS

When adopting m-learning, the analysis and selection of the best suitable solution, among diverse technological options, is crucial. For instance, the computational platform would be developed based on cloud computing instead of the traditional client-server architecture (on premise or outsourced) because of the benefits of costs, scalability, ubiquity and functionality that this model offers.

The UPS academic software (AVAC) is developed over the Moddle 3.1 LTS platform. Moodle counts on servers belonging to the company Amazon.com. Although UPS does not count on the current Moodle version (3.2.2+), AVAC is a low-cost

efficient system when compared to the installation of own servers in UPS facilities.

Furthermore, the UPS digital library has been developed using the open source repository software DSpace, which offers a large compilation of books, thesis and, academic and scientific papers, of all the fields of study offered at UPS. DSpace allows an easy access to the digital repository in a safe manner, the update of the elements in the database without affecting its performance and the storage of thesis and papers written by students and Lecturers.

Despite going through the UPS website from a smartphone or a tablet is very intuitive, finding a file stored in the UPS DSpace includes several steps that could be reduced. The query forms are not very user-friendly and can become complex to students not deeply familiarized with mobile technology. These two aspects influence the low acceptance and scarce utilization of the digital repository if consulted through mobile devices.

Regarding to the mail server and virtual storage space, they are offered by Microsoft Office 365. These characteristics contribute to the system with certain level of cloud computing. The possible data collision, when accessing the servers in the USA, and the local services contracted, such as virtual server capacity and bandwidth, determine the failures that could arise by using this configuration.

Contrarily to the servers mentioned earlier, the web server (ups.edu.ec), the management system for academic coordination (UPS National Academic System - SNA) and the biometric control system are physically set up in the UPS facilities. This type of local configuration optimizes response times and avoids the loss of sensitive information, but it reduces the level of automation and cloud computing.

UPS students developed a prototype of a mobile app for access to the AVAC[25]. It had a very simple interaction interface, very intuitive and very user-friendly, and it had primary functions for both students and teachers. It could have been easily downloaded and run using any mobile device because it was developed for both iOS and Android systems. This prototype, or any other, could be used to provide access to the AVAC with an optimized service for the mobile devices.

In addition to the technological improvement required to integrate m-learning into the UPS educational model, encouraging the digital transformation is also indispensable, because it adds value to the educative process, strengthens the university foundations and endows working knowledge against new circumstances[26]. This transformation does not only presuppose the incorporation of technology in the education, but also the aggregation of digital processes in the current teaching methodology, including processes automation, online academic services, online file management, training and update on digital education for both teachers and administrative staff, among other aspects[27].

In order to success after the implementation of m-learning in the educational model, it must be considered the limitations of bandwidth and capacity that UPS could suffer. A good internet access service is essential to offer m-learning tools to

each student, such as file downloads and videoconferences with lecturers. Thus, achieving the maximization of the mobile education experience.

The offer of m-learning always follows a bottom-top order in complexity. This means, the very first stage must involve teaching a course compatible with this type of education during the first semesters of the trial. Then, it is important to broaden this methodology among other courses. Later, some short programs can be fully taught using e-learning and m-learning methods. Finally, postgraduate and undergraduate programs can be offered under this model.

VI. STUDENTS' OPINION

The research carried out by Lupino and Gonzalez [28] on the student reading habits and the utilization of UPS library, during the years 2012 through 2015, became the primordial point for this argumentation. The population under analysis comprised students, at their first semester, enrolled in the fortieth period (May 2012) that continued studying at UPS until the forty seventh period (October 2015). The selected sample embodied 217 participants and the proportions were defined according to the number of students registered in each undergraduate major.

The outcomes showed that the 55 percent of the respondents reads frequently, however, only the 33 percent of the sample stated visiting the library once or twice in a semester.

Specifically, this data is considered relevant for this study, because it poses the question 'what are the means and spaces used for reading among students' since they do not choose the library, where they may find a huge variety of topics and the necessary conditions for promoting reading, and consequently, research and the update of contents.

TABLE I
CHARACTERISTICS OF THE RESPONDENTS

Characteristics	Frequency
Age	
17-20	17
21-25	16
26 and older	4
Gender	
Female	21
Male	16
Semester of study	
First semester	19
Eighth semester	18

A posteriori, four focus groups were carried out, composed of undergraduate students from both Social Communication and Electrical Engineering majors. Two groups consisted of students enrolled in forty-eighth period, at first semester and, the other two formed with students enrolled at eighth semester in the same academic term. Hence, each group comprised only

students enrolled in the same major and in the same semester. The focus group sessions were held in one of the cubicles located at the UPS library. Each session counted with the active participation of eight to twelve students (See Table 1).

The interrogation 'what are the means and spaces used to read?' was the opening of the debate. On one hand, each group mostly referred to the internet and its easiness, regardless the veracity of the sources and their contents. On the other hand, tablets and smartphones constitute the devices more used to read because they allow participants make consultations and study even in the public transportation, as expressed by themselves.

In regard of the databases (WoS, SCOPUS, EBSCO, IEEEXplore, Ebrary) that the UPS students have access to, nearly all the opinions coincided on the lack of utilization of these. The main reasons, some respondents stated that most of the texts are in English language, others expressed both the difficult access to the UPS text catalogs, when away from the university facilities, and the long procedure to do so (search UPS website / validate the access via username and password / choose the database / go through the query engine /…).

Continuing with the debate on bibliographic search and the importance of the veracity of sources and their data, the participants inquired about the likeliness of developing a module in the UPS website system with direct access to the digital repository and the likeliness of developing a mobile app that contains this feature and others. They were asked about the characteristics this app should possess. Fig. 1 summarizes the most significant opinions.

As a students' suggestion, the app they ask for should be innovative and should easily provide access to the documents stored in the UPS digital repository. Other suggestion was that the app should be linked to both the assignments and messages posted in the AVAC. These two suggestions would allow students check the assignments posted by lecturers, read the lectures material, also posted by lecturers, and consult relevant texts directly from the repository, all using the same app.

The respondents also explained that this learning modality should not be the only one in the UPS; the main argumentation was the access to the required technology. They commented experiences about teachers who have tried to give written tests to the students through AVAC during classes, i.e. performed in real time and simultaneously to all the course participants. Most of these test ended up being cancelled, because some classmates own devices that do not thoroughly fulfil the technical requirements for this type of evaluation, causing delays that leave them behind or makes the tests nonexecutable. Few others do not own smartphones or tablets, what precludes them from taking the tests.

On one hand the first-semester students' criteria returned a bigger interest for the incorporation of mobile devices into the learning process, arguing that everything is more easily done by using this technology, including studying. On the other hand, eighth-semester students' opinions recognized the importance
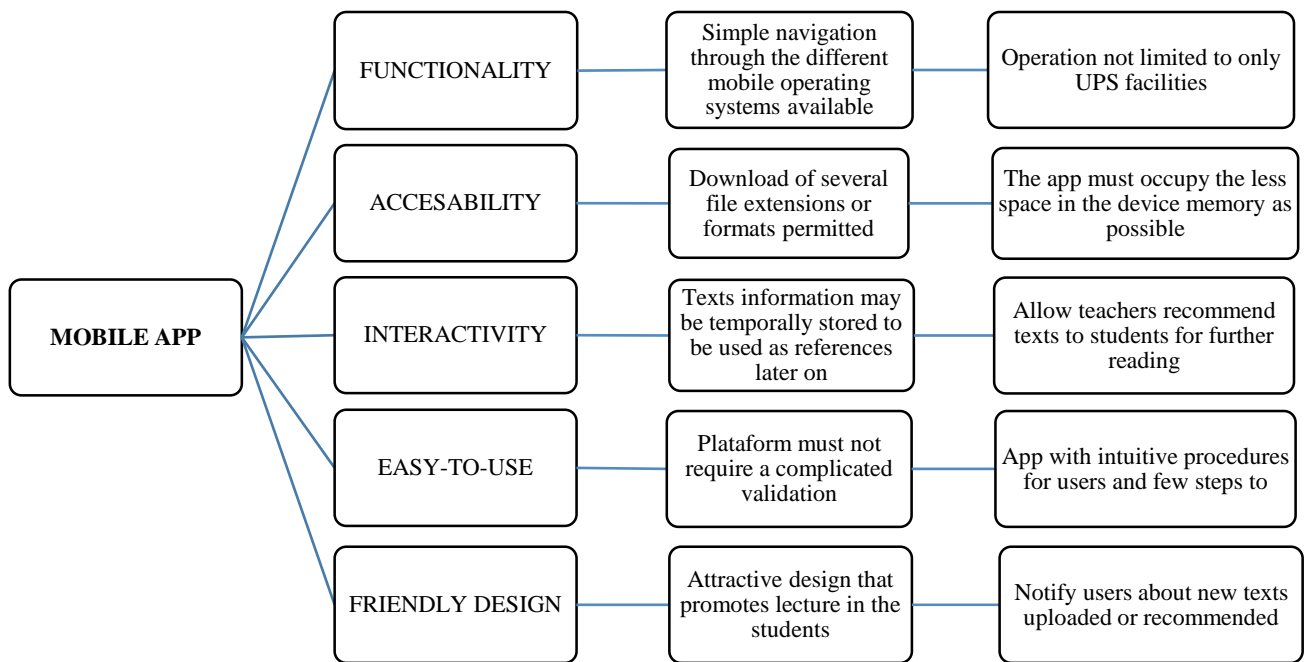
Fig. 1 Systematization of app criteria

of reading conventional books, whereas for the degree project, they would rather work with digital repositories because of the up-to-date papers offered.

During the sessions, it was implicit and explicit that the students' preference is the utilization of mobile devices, in different life facets, including the university education.

For many of the polled students, the first semesters of study were founded and supported by their parents but, due to the recrudescence of the national economic crisis, their reality experienced a tough transformation. This alteration of their status provoked their inclusion into the workforce and to switch their courses to the night time session (workdays from 6pm to 10:15pm, and Saturdays from 7am to 5pm). Making the mobile devices to become an essential tool, for the students, to read and do assignments, whenever and wherever they have the free time.

Other positive features of using the mobile devices came out. Among these features were mentioned the capability to make phone calls, to take photos for evidence, to record audio and video for interviews, logs, field visits and field researches. Some other ideas expressed by the students on how to include didactic tutorials and interactive videogames in the teaching-learning process were very innovative and taken under consideration by the researchers. In addition, something worthy to highlight, from the debates, was the availability of the UPS students, particularly those in their eighth semester, to participate in the conception of the main ideas of this research topic and to collaborate in the development of this research and its tools.

VII. CONCLUSIONS

The implementation and performance of m-learning in the UPS could be interrupted by unavoidable country issues of technologic, economic, cultural or social nature. Other aspect known are the mobile devices limitations, such as battery duration, screen sizes, limited capacity for processing and storage if compared to laptops. Individual factors like the users' purchasing power and communicational barriers constitute other elements to be considered among the constraints as well. However, if the approval of m-learning in UPS, and moreover in the country, is attained, it will support the development of virtual education, what would bring education to remote areas, communities with difficult access and the less favored sectors of society.

For the correct implementation of the m-learning in developing countries, it must consider that each country has a different technological infrastructure for access to the internet, dissimilar penetration levels of mobile technology, diverse social standards and a mix of users' behaviors. So, a solution found and implemented in a country with superior quality education is not necessarily the optimum solution for a country just willing to implement m-learning in its educational system. In the case of a country wanting to adopt solutions from countries with a highly-evolved education, it will be mandatory to perform a feasibility assessment and, according to the results found, to proceed with the exhaustive analysis of several solutions considered and applied by different countries, what will help establish the most convenient strategy that suits best each country reality.

Although it seems that the UPS owns the technological foundations to include m-learning in its educational plan, the truth is that it lacks of imperative elements to reach a real maturity level of this modality of education. None of the degrees offered by the UPS at Guayaquil proposes digital classes, videoconferences or completely virtual courses.

Similarly, other than the access to the ScienceDirect and IEEE scientific papers repositories, the UPS does not count on a great repository containing an up-to-date compilation of books, reports and other academic and professional documents that are relevant to the UPS research lines. Besides, it lacks of a homogenized virtual evaluation system that complies with the basic evaluation requirements and contains a common database of questions shared among the different groups of a same course or subject.

The UPS should provide students with e-portfolios to consolidate their academic essays, project reports and research papers because, despite the OneDrive service included in Microsoft Office 365, there does not exist a specialized virtual environment for student collaboration. The last element to be considered it is the students' ethics on internet-shared information and plagiarism matters, which is very low, what would convey to the decrease of individuals' performance and development as well as a bad quality of their assignments.

The group discussions allowed contrast certain data to the student demands and the contemporary context in which the undergraduate education takes place. The technology is increasingly used in daily life, which sets more and new challenges to be succeeded by an education capable to adapt to this ever-changing environment. However, current limitations for the implementation of m-learning in the UPS were identified, from the detrimental infrastructure to student socioeconomic disadvantages regarding the acquisition of smartphones and internet plans.

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