

The use of Mobile Technologies in Higher Education in Portugal: an exploratory survey

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Abstract: In the European region, the use of mobile learning is already a reality. As a result, studies in the field started to arise in Portugal, both at the higher education level and at the secondary education level. In order to get to know the use that the Portuguese academic community makes of the mobile technologies, either for personal or classroom use, a survey was carried out with students, professors, researchers and staff from public and private universities from north to south. The findings show that the majority of the community members have sufficient technological means to access this kind of technology. In spite of this, it is still not widely used, even though the individuals believe in the potential of its didactic implementation.

Key words: M-learning, Mobile Technologies, Internet, Technologies

1. Introduction

In the global society of the XXIst century, the Internet is not a simple communication technology, but the epicentre of many of the areas of the social, economic and political activity, becoming, in the view of Manuel Castells, “as the technological instrument and the organisational means that distribute the power of information, the creation of knowledge and the ability to network in any of the human activity scope (Castells, 2004: p.311).

The technological development of the production of integrated circuits, which occurred, mainly, during the last decade, has made possible the development of computational devices that now have a new paradigm: the mobility. This paradigm is changing the way we work, the way we communicate, the way we have fun, the way we study and the way we do other activities when we are on the move or when we do not wish to depend on a fixed infrastructure of data communication (Loureiro, Sadok, Mateus, Nogueira & Kelner, 2004). Individuals no longer belong to specific groups and are not bounded to geographically defined territories (Moreira & Pon, 2003).

Nowadays the use of technologies is essential to schools, either at the hardware or software level, since it adds a number of benefits, the first of them being the expansion of the educational boundaries and possibilities. The equipment downsizing has launched new mobile technologies such as: notebooks, calculators, PDA (Personal Digital Assistant), smartphones, mobile phones, electronic agendas, pagers (also known as bips), among many others. Additionally new needs have emerged, the main being: the access to information and the individuals’ connectivity.

The mobile learning or m-learning is characterised by the use of mobile devices in the teaching and learning process. This modality allows learning to be independent from time and geographical space limitations with maximum mobility and connectivity (Bottentuit Junior & Coutinho, 2007). In the European region m-learning is already a reality. In Portugal some uses in the field started to arise both in the higher education and secondary education. In order to get to know the use that the portuguese academic community makes of the mobile technologies, either for personal or classroom use, a survey was carried out with students, ex-students, professors, researchers and staff from public and private universities from north to south.

2. Mobile Technologies

The communication and information technologies (CIT), due to the extraordinary evolution of the scientific knowledge, which the technologies themselves also restrain, have been, in the last decades, structural for: new forms of work organisation (telework, mobile work, blended work both present and at distance), production and consumption (e-business and e-commerce), communication, new relations with the information and the knowledge (e-learning, m-learning, b-learning). (Coutinho & Bottentuit Junior, 2007a).

The mobile technologies did not emerge recently, it is an old concept, but it has been evolving every day due to the huge possibilities that are being added to the devices. Heisenberg had already stated that: “in the future,

technological devices are going to be, probably, inseparable from men, such as the shell from the snail and the cobweb from the spider". (Silva, 1999, p.53).

The mobile technologies are exactly what its name refers, i.e., portable technology that can be moved from one place to another without any loss. Examples of these technologies include: the laptops or notebooks (portable computers), Palmtops or PDAs, *smartphones*, GPS devices (*global positioning system*). Mobile devices can still be set for the use of a variety of communication technologies, such as: wireless communications (WiFi), Bluetooth, which connects wireless mobile devices, third generation (3G) and Virtual Private Network (VPN).

The mobile technologies have become popular mainly due to the continuous evolution of the so-called "handheld computers" and mainly in the advance of the resources available in the mobile phones and portable computers. Nowadays, owning a mobile phone is no longer a luxury or fashion, it became a need, meaning, it has to be immediate in order to avoid great material or financial losses. Another reason why mobility is very appealing is because these devices allow access to data and information in any given moment or place, becoming a powerful attractive to individuals. In spite of its relatively low cost (comparing with the price of a personal computer), the devices can perform tasks similar to a computer and in a mobile and ubiquitous way.

According to the Wikipedia site, all technology that allows its use while on the move can be considered a **mobile technology**. The mobile technology is not only an invention, it can be considered a revolution, since it was capable of becoming part of people's lives, changing their routines and the way they make decisions.

As we have seen on figure 1, there is a wide range of devices with different functionalities. Still, the most common device is the mobile phone. To Ferrari (2005) the first generation (1G) of mobile phones was the analogic and the second (2G) was narrowband digital. At present we are at the third generation (3G) digital broadband for multimedia. This technology allows several transformations, such as: multimedia transmission (audio and video), video-call, Internet access with faster speed (**wireless broadband**) and with more accessible costs, as well as digital TV via mobile phone, **music download, the possibility to download and upload videos, to access 3D games** with multiple players and global positioning with GPS, from any mobile device. With these new functionalities as well as the better performance and high rates of data transmission, the wireless devices are becoming real mobile stations of: entertainment, service and study. The main services can be summarised on 5 large areas: (1) Basic Communication (Fix Voice and Mobile Voice), (2) Static Information (Diverse Propouse), (3) Multimedia Communication (E-mail, Text Message (SMS), Multimedia Message (MMS) and Video Conference), (4) Multimedia Entertainment (Audio, Video and Oline Games), (5) Interactive Services (Virtual Banking, Shopping (E-commerce), Education (m-learning), Telemedicine). The services mentioned above combine both conventional mobile phone features with computer functionalities. The companies' competitiveness and the continuous search for market place turns the investments on these devices indispensable. The great increase in sells and use of mobile phones, Smart Phones and PDA's with Internet access induces the content development for these devices to be a matter more and more discussed both at the educational and the technological mean. We live in a society where knowledge is more and more valued and, due to the accumulation of activities imposed to us, we have less and less time to manage so many tasks at the same time. Learning anytime and anywhere is attracting increasingly more followers to this modality, i.e., distance education and training occupies a greater space in our daily life (Bottentuit Junior & Coutinho, 2007). According to Metcalf, 2001; Bottentuit Junior & Coutinho, 2006; Bottentuit Junior & Coutinho, C. P. 2007; Bottentuit Junior, Negretti & Coutinho, 2007; Paes & Moreira, 2007, these devices when applied to teaching allow: Classroom extension beyond the physical localisation; Incentive to the use of Communication and Information Technologies in the classroom; Message sending (e-mail and MMS, SMS); The access to electronic resources when a PC or a laptop are not available; Communication with a students and teachers' community beyond the institution space/time boundaries; The practice of field work outside the classroom, for instance, data collection, experiment record, electronic books reading (e-books) or case studies, as well as library research; Administrative information consultation, for instance, schedules and exams' dates; Among several other possibilities.

We believe that the Internet future is mobile and that learning through the distance modality will attract more and more students. Thinking on this possibility we have developed a virtual laboratory prototype to be accessed through mobile devices.

3. The Study

In order to get to know how the mobile technologies are used by the teaching system in Portugal, we have decided to start off by listening to the students, professors and researchers from several portuguese universities and polytechnic institutes. The reason why we have chosen the higher education academic community, in this first phase of the project, had to do with suitability and data accessibility, since it is in this teaching level that researchers develop their

professional activity. According to Babbie (1997), the survey is a data collection method, which allows the gathering of information by questioning the subjects and it is the most adequate process for enquiring large samples. In our study, and since we did not know the population's dimension and structure, we have resorted to a sample selection method of non probabilistic type (Charles, 1997), which combines either aspects from purposive type and convenience sampling (Shutt, 1999) since they were both taken into account and simultaneously: i) specific criteria for the selection of subjects to be questioned (students, professors or researchers in higher education institutions in Portugal), and ii) the easiness to access the contacts of the enquired subjects (e-mails).

Aware of the fact that the findings of a survey carried out upon a non representative sample of the population causes impediments to any ambition of the generalisation of the results beyond the questioned group (Black, 1993; Schutt, 1999), it was the researchers' concern to interpret the data always bearing in mind this methodological limitation. The electronic survey was designed in the monkeysurvey.com application, which allows the creation of personalised models and an easy management of the collected data. The questionnaires started being sent on the 30th December 2007 to the students and professors' e-mails of the institutions where the authors develop teaching and research activities (University of Minho and University of Porto). For study purposes there were used dynamic e-mail addresses of the institutions we had access to, as well as addresses obtained from a search on the pages of the universities and polytechnic institutes that had Internet sites.

Besides these two universities, there were also sent e-mails to professors and researchers from other high education institutions, with whom the authors had personal/ professional relationships requesting them to forward it to professors and students from their own institution. With this procedure we were able to access the e-mail contacts from several other universities and polytechnic institutes, but which importance in the total of answerers was always very little compared with the number of enquiries answered by the academic communities of the universities of Minho and Porto.

3.1 Data collection instrument and Sample Characterisation

In order to accomplish the survey it was applied a single electronic enquiry named "Mobile Technologies: Personal use versus Classroom Use". The enquiry developed by the authors was formed by 16 questions organised in function of the objectives: a) subjects characterisation; b) Information about the ownership and use of mobile devices; c) Information on mobile learning and attitudes concerning this teaching modality. As referred previously, in this study, we used a non probabilistic purposive type sample, in the sense that the selection of the enquired group was made based upon the criterion of belonging to the portuguese academic higher education community. As the answerers recruitment process was made from the easiness of access and the authors personal and professional relationships, the final sample is of convenience and its representativity is limited to the enquired group, not being possible to extrapolate the results beyond itself (Shutt, 1999). For statistic analysis purpose, we have counted with a total of 1.166 valid inquiries, which were submitted to us until January 15th 2008, last date established by the authors for receiving the fulfilled forms.

Data Treatment

3.2 Data Treatment

The statistical treatment of the information obtained was carried out using Excel, a mathematical programme for data treatment, which is included on the Microsoft Office products package. The data was treated with descriptive statistical techniques that, according to Wiersma (1995), are aimed to provide the researcher with a first reading of the information contained in the data, which is capable to give indications about the dispersion, the distribution shape and structure, understood as a set of all the observations obtained in the study of a variable. For the data presentation, frequency and percentage tables were used. For analysis purpose it was only considered the valid answers, i. e., the unanswered questions were excluded from the total score.

3.3 Analysis and Results Discussion

Of the 1.166 individuals who answer the electronic enquiry, 59% were male and 41% were female, 63% were between 18 to 25 years old, 19% were between 26 to 35 years old, 10% were between 36 and 45 years old, 6% were between 46 and 55 years old and 2% were older than 56 years old.

When enquired about the university situation, 55% answered that they were academic degree students, 18% post graduation students (specialization courses, master's degree, doctoral degree's, post doctoral), 19% were university professors, 4% were in the others category (researchers, scholarship owners and other occupations) and finally 4% were ex students.

There were 22 portuguese institutions of higher education involved in the study: Polytechnic Institute of Beja (0,7%), Polytechnic Institute of Bragança (3,3%), Polytechnic Institute of Guarda (0,6%), Polytechnic Institute of Leiria (2,7%), Polytechnic Institute of Setubal (0,9%), Polytechnic Institute of Viseu (0,3%), Polytechnic Institute of Porto (1,9%), Portuguese Catholic University (0,1%), University of Beira Interior (0,8%), University of Madeira (0,6%), Universidade of Aveiro (2,3%), University of Coimbra (0,3%), University of Évora (1,0%), University of Lisbon. (0,9%), University of Algarve (1,4%), University of Minho (34%), University of Porto (45%), University Fernando Pessoa (0,9%), University Nova of Lisbon (0,1%), University Portucalense (0,6%), Technic University of Lisbon (0,1%), University of Trás os Montes and Alto Douro (1,4%).

As it was expected it was on the Minho and Porto Universities (institutions where the researchers had access to the larger number of e-mail contacts) that most of the valid questionnaires in the survey were obtained; together the members of these two academic communities represented 79% of the total number of subjects who integrated the sample.

3.3.1 Ownership and use of the mobile devices' services.

The first and one of the most important questions for the validity of the rest of the questions in this section was to enquire the ownership of mobile devices. When they were questioned if they owned a mobile phone, smartphone, PDA or other mobile device, 88% said they owned a mobile phone and 11% of those individuals answered that besides the mobile phone they also had a PDA or smartphone, and only 1% said that they did not have any kind of mobile device. Nowadays, mobile devices offer a very varied range of services. Among these we can exemplify the messages services MMS, SMS, the digital video and photography, access to the Internet, chat (Messenger), mp3 and mp4. According to the findings, 72% revealed to have access to the internet from a mobile phone, only 25% said they did not have access and 3% were not able to inform if they had it or not.

The message services are the most used. About 76% of the enquired informed that they use that service many times. Regarding the photographs and digital videos, these are not very utilised. If we sum the categories "less" and "almost never" we have then, more than half of the individuals (64%). The chat service via mobile device presents a result that demonstrates the little success of this functionality among the academic community, i.e., 46% reveal that they have never used this service. Another possibility of these devices is its use as a means for audio files.storage For this service 78% of the individuals reveal that they use often this functionality. This high number can be explained by the high number of participants between the ages of 18 and 25, who seems to use this resource regularly. More details on the results obtained in the use of the services are found with a more precise description in table 2.

Via Mobile Device	Much	Less	Hardly Ever	Do not know how to use it	Never Used	Do not have access to
Uses the message service	76%	19%	3%	0%	1%	1%
Uses the digital photography and video services	16%	40	24%	1%	6%	14%
Uses the chat (Messenger)	3%	7%	13%	2%	46%	28%
Uses mp3 or other audio file	78%	24%	17%	1%	19%	21%

Table 2: Mobile devices' services.

3.3.2 The use of the mobile device in an educational context

As we have seen in the literature revision, mobile learning is characterised by the use of mobile devices in the teaching and learning activities. When enquired if they had ever heard about mobile learning (m-learning), only 39% revealed they knew the concept, while more than half (61%) still did not know this teaching modality.

When we questioned the individuals if they had used some kind of mobile device in interaction with some learning practice (in education) the great majority (48%) revealed they had never used any kind of device. However, 25%

state that they had used mobile phone, 15% the tablet computer, 7% the pocket PC and 5% the Palm or PDA. In this last question we asked the subjects for an opinion on aspects regarding the educational potential of mobile devices. For this we have used a 5 point Likert scale (Strongly disagree, disagree, neutral, agree, strongly agree) and 8 items to check the degree of concordance / discordance of the individuals. From the created items there were 4 disposed in the positive and 4 in the negative (they should be interpreted in reverse). The Likert scale is an ordinal scale and therefore it measures how it is more favourable or unfavourable in a certain opinion/ attitude. It also allows a good base for a first degree ordination according to the subjects of a sample, regarding the characteristic that is being measured / evaluated (Pinedo, s/d).

According to the table 3 analysis, where there is an highlight on the frequency of individuals who had answered each item and the absolute values of the degree of the dominant agreement, we can draw in perspective a general frame of very favourable opinion of the subjects of the sample, regarding the educational potential of mobile devices in education.

Moving towards an item to item analysis, we have decided to recode the nominal variable “degree of concordance” in order to facilitate the reading and interpretation of the results. For this purpose, we grouped the categories “Strongly Disagree” and “Disagree” in a new category corresponded to a “Discordance” opinion; and the categories “Agree” and “Strongly Agree” were grouped in a category corresponding to a “Concordances” opinion and the category “Neutral” was renamed with the final designation “Indifferent”.

Items	f	Dsicordances	Indifferent	Concordances
I believe in the educational potential of mobile devices	1158	107	269	782
I would like to use mobile devices in the classroom	1151	187	320	644
I do not believe in learning with the use of mobile devices	1151	733	259	159
I believe that in the future there will be a greater use of mobile devices in education	1153	57	140	956
I do not know any site or specific software for mobile devices	1149	478	209	462
I think that it is a good idea the possibility to access the subject's content in any place and any time from a mobile device.	1148	60	109	979
I do not use the mobile devices' services in the classroom because I do not know them or due to the lack of technological structures.	1140	469	279	392
I do not know any strategy where mobile devices can be used.	1141	525	313	303

Table 3: Concordance degree on the opinion of mobile device use in educational context

The vast majority of the individuals involved in the study stated that they believed in the educational potential of mobile devices and that they would like to use them in the classroom. This is also confirmed through the obtained data in item 3, which should be interpreted in reverse, since it is written in the negative form. The enquired also stated that in the future there will be a greater use of mobile devices in education, as well as that it is a good idea to have access to the subject's content in any place and any time from a mobile device. Students also disagree that they do not use the mobile devices services in the classroom due to ignorance or lack of technological structure, as well as discording not knowing any strategy where mobile devices can be used. There was a very large balance between concordance and discordance when we calculated the results of the item "I do not know any site or specific software for mobile devices".

4. Conclusions

Mobile devices pose challenges to teachers and students specially in higher education. We need to open doors to new scenarios, in either formal or non formal education, provided by the mobility offered by this kind of devices. Therefore individuals may assume the role of active elements in a technological society. As we have seen in the literature revision, the devices can break time and space boundaries and allow the education to occur in accordance with each individual's cognitive level, as well as the access from any geographical place.

The findings of the survey undertaken with the members of the portuguese higher education academic community sample, confirmed a reality that, in a certain way, we had already foreseen: i) the majority of the enquired own mobile devices equipped with services and access to the internet; ii) the most used services by the enquired are the instant messages (MMS and SMS) as well as the audio files; iv) there is still little use of these devices in the classroom; v) the majority of the enquired academic community is not familiar with the mobile learning concept; vi) even though the academic community, who integrates our sample, does not use the mobile devices in educational context, they do believe in the educational potential of these devices and they also would like to use them in their daily activities. In sum, we can conclude, by evaluating the sample answers, that the portuguese higher education academic community is now technologically prepared for this new teaching modality, even though considering that its expressive numeric size is not representative of the population. However, in pedagogical exploration terms, its use is very limited, requiring a major incentive and also teachers training in order to integrate these devices in teaching and learning.

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