

Instructional Approach in Adult Education using Mobile Devices

New chances for lifelong learning

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Abstract—Mobile technologies are currently present in many instructional areas from basic levels to higher education. This work is focused on studying the impact of these technologies in lifelong learning contexts, and more exactly, concerning adult education. To this end, an approach is proposed to organize the different items involved within an instructional process with the purpose of taking advantage from the use of mobile devices. Such approach has been applied in a course addressed to people older than 55 years where the potential of mobile technologies has been assessed to promote a more customized learning adapted to the adult learner profile.

Keywords- Mobile devices; Instructional design; Life-long learning; Adult education

I. INTRODUCTION

Mobile technologies are currently present in many instructional areas from basic levels to higher education. The UNESCO work [1] about Mobile Learning or the Horizon Report [2] recognize the broad extension of tablets, smartphones and similar devices in different learning scenarios. Other initiatives also show the application of these technologies in basic education levels [3], instruction for academic physicians [4] or mobile learning trends for postgraduate students [5]. The current work is focused on studying the impact of these mobile technologies in life-long learning contexts, and more exactly, concerning adult education.

Lifelong learning comprises a wide period of time in which people remain engaged in the process of learning either in formal or informal contexts, by means of training procedures or motivated by personal interests. Therefore, there are many individual situations and circumstances that characterize this kind of learning so instructional and teaching methods have to fit them [6]. Mobile technologies are able to offer special support to these methods and this research work intends to integrate such technologies in a general instructional approach.

In the case of adult education, there are additional aspects to be addressed including those barriers that burden the incorporation of elder people in lifelong learning processes [7]. Such barriers can be removed or lowered by applying technology applications and sound instructional methods.

This paper proposes an instructional approach to guide the application of mobile technologies in adult education contexts. These technologies provide several interface features that allow users to deal with mobile devices in an easier and intuitive way compared to traditional desktop or laptop-based applications. Even, handicapped people or adults with special needs have diverse mechanisms to interact with these devices. This circumstance contributes to a more customized and adaptive learning. Nevertheless, this diversity of interface options provided by mobile technologies makes also difficult to organize or manage their instructional potential. Moreover, the continuous arrival of new mobile devices and those educational contents and tasks based on them is also a factor that complicates the generation of guidelines and procedures to take advantage of such technologies. This situation is particularly critical for adults who are not used to face quick and disruptive changes in their learning process.

The instructional approach presented addresses several issues that range from the technical opportunities offered by mobile devices to the special learning needs that adult users require. All these issues can be framed in a context of *Instructional Design* as the discipline that provides a systematic and rigorous process of managing resources and activities in learning processes [8]. Ozdamli [9] and Park [10] described several pedagogical frameworks in mobile learning contexts to drive technology deployment in an effective way. Sharples et al. [11] proposed a learning theory that fit mobile environments and Elias [12] formulated several instructional principles in the design of such environments. More recently, Dillard [13] collected a set of recommendations to instruct adults by means of mobile technologies. The current approach intends to formalize some of these guidelines and recommendations, and it has been evaluated in the context of a course about *Mobile Technologies* oriented towards adults older than 55. The remainder of the work is organized as follows. Section 2 introduces the instructional approach proposed in this paper and Section 3 describes the case study used to assess it, as well as the evaluation outcomes and their discussion together with some lessons learned. Finally, some conclusions and further works are reported.

II. INSTRUCTIONAL APPROACH

An instructional approach is proposed to organize the different items involved in those learning processes concerning adult education. Such approach deals with technical aspects related to mobile technologies but also takes into account learning requirements for users with specific needs. Therefore, a framework is required that addresses all these technological and instructional issues. In this paper, the ADDIE model [14] provides a sound instructional framework that also has been applied in technological contexts. ADDIE stands for *Analysis, Design, Development, Implementation and Evaluation* and it provides a general model to represent the several stages that are part of instructional processes.

The *Analysis* stage is crucial to gather those learning needs expressed by users. Adult education covers a broad landscape of scenarios ranging from training courses to more informal learning contexts. The current work is focused on such informal scenarios addressed especially to elder people (more than 55 years-old) who are sometimes handicapped users or have special needs. Sometimes, these users also lack knowledge about technological notions though they are usually motivated to learn this kind of topics. From these requirements, the *Design* stage can deal with the formulation of goals that fit such requirements as well as the selection of educational resources and activities adapted for the needs of their users. Figure 1 shows a concept map that displays some of these *Design* components that are part of the proposed approach. For example, procedural goals can be based on achieving psychomotor skills by using keyboard in cellular phones or promoting self-organization abilities by means of scheduling apps. Moreover, resources, such as photo galleries or video recording can be easily accessed in these devices and activities, either individual (e.g., elaborating a personal agenda) or group-based (e.g., exchanging messages in a social network) that can contribute to improve self-esteem and other emotional issues.

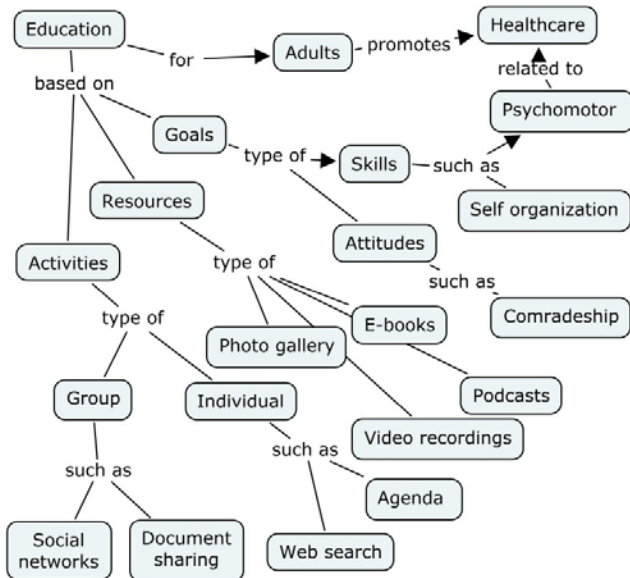


Figure 1.- Instructional process concept map.

The next stage concerns the *Development* of resources and activities, which can be applied in adult education. Several examples have been already mentioned and mobile technologies offer a wide spectrum of tools to develop them. For example, cameras in tablets and smartphones permit to take pictures or record video clips in a simple way. These devices also enable the processing of Quick Response (QR) codes to access different types of contents. Learning activities can be also benefited from the use of mobile technologies through the multiple applications available in distinct platforms and the multimodal interfaces provided by these technologies. Figure 2 shows a concept map that displays some of the technological possibilities offered by mobile devices. During the *Implementation* stage these resources and activities can be delivered by means of several environments and learning systems. In this sense, the most popular Learning Management Systems (LMS) provide adapted versions that fit with mobile features. Moreover, the use of HTML5 and CSS standards are pushing educational Web sites to be adapted to different screen sizes and device configurations applying responsive design principles. This circumstance allows users to easily access their educational contents and services through multiple mobile devices [15].

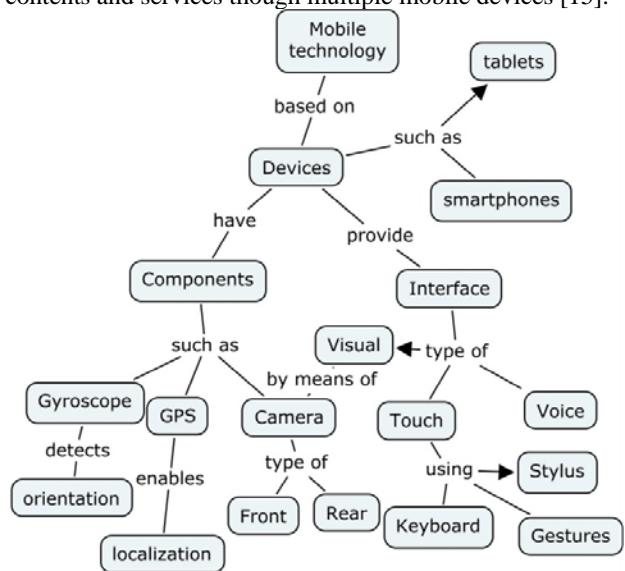


Figure 2.- Mobile technology concept map.

The last stage in the proposed approach deals with the *Evaluation* of the learning processes when mobile technologies are deployed. A first method is used to gather personal opinions by means of questionnaires that are submitted during these processes. This kind of data source is very useful to evaluate the point of view from users who are using mobile devices reporting their qualitative perception about the learning experience. However, a more objective or quantitative way is ever required to get a less “invasive” point of view that provides neutral data from such experience. There are several methods to assess these interactions, such as “eye tracking” techniques, control of user gestures or tracking down the several applications that users run interacting with their mobile devices.

III. CASE STUDY

The current research work has been based on a case of adult education in which the proposed instructional approach has been applied. This case study is integrated in the Senior University program developed at Universitat Politècnica de Valencia (UPV). Next subsections describe the context of this academic program and present some courses about mobile technologies delivered in this context.

A. Academic context

The Universitat Senior at UPV offers more than fifty courses to people older than 55 years. Every year about three thousand students join these courses that address several topics from general cultural issues, such as arts (e.g., music, sculpture or movies) to health and technology. The current case study is part of the courses focused on information and communication technologies and it complements other courses about computer basics, internet or office applications. In general, these courses have a high level of demand and their registration is mostly bounded by technical restraints imposed by those facilities deployed to deliver them. In most of the technological proposals, the number of registered users is about thirty students by course and one special feature is the huge diversity of user profiles that attend these courses. Many of them have completed higher education studies (degrees or masters) though they come from very different disciplines with sparse knowledge in technologies. This aspect sometimes makes teaching these courses difficult but the high motivation and the student’s degree of commitment, generally, compensates that situation.

B. Courses about mobile technologies

There are two types of courses offered to senior students that are addressed to teach mobile technologies:

- *Introductory* courses that covers basic concepts about this kind of technology.
- *Advanced* courses addressed to people with previous experience in these technologies.

The first type of courses allows users to get some starting ideas about the use of mobile phones and tablets and no prior knowledge is required. These users usually own these devices though in most cases they are only used as traditional phones for merely calling people. Table 1 shows a description of the main contents delivered in these courses and their weekly scheduling.

TABLE I. INTRODUCTORY COURSES

Contents	Weeks
Introduction to the world of mobile phones and tablets. Physical handling of the device.	2
Device configuration and customization. Choosing your tablet / smartphone.	2
Communication applications: e-mail, chat, videoconference. Apps instalation. .	3
Multimedia applications: camera use, image gallery, audio and video storage, e-books.	3
Internet: web browsing and search engines.	2
Social networks. Health and travel applications	2

Advanced courses require a previous experience in the management of mobile devices, for example by means of *Introductory* courses or being users of smartphones or tablets. These courses add an extra knowledge about more sophisticated services provided by these technologies, as well as practical activities over them. Table 2 shows a description of course contents and their scheduling by weeks.

TABLE II. ADVANCED COURSES

Contents	Weeks
Advanced settings of mobile phones and tablets. Technical details of mobile fundamentals.	2
Managing several device interfaces. Analyzing multiple tablet / smartphone devices.	2
Mobility applications based on GPS. Agenda and calendar services.	3
Advanced multimedia applications: image edition, audio and video processing.	3
Internet advanced search queries. Apps management.	3
Electronic commerce, shoping using your mobile device. Network security.	3

C. Course resources

The instructional resources and material used in the presented courses are stored on a Web portal implemented by means of a blog tool. Figure 3 shows a screenshot sample of this portal that displays an activity description addressed to teach users how to setup their mobile device. Most of the resources are focused on practical activities that promote the acquisition of different types of skills together with knowledge about mobile technologies.

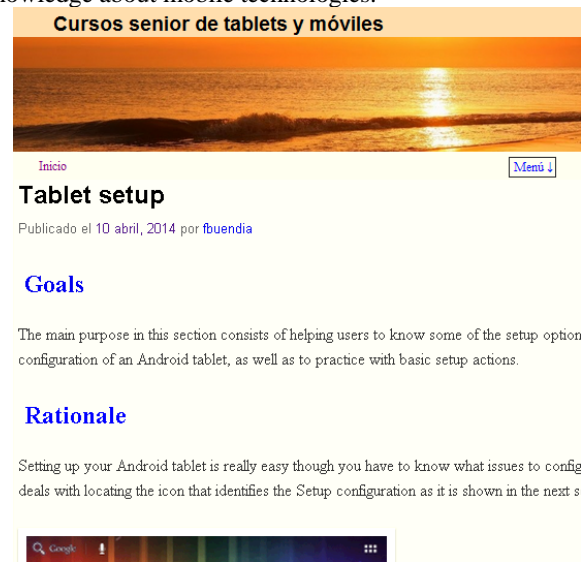


Figure 3.—Web portal for mobile technology courses.

Basic abilities are addressed in *Introductory* courses to enable simple motor skills using the smartphone keyboard or short term memory by means of routine tasks using tablets. Advanced courses encourage other abilities, such as self-organization through calendar activities and systematic search procedures through the Web.

IV. CASE IMPLEMENTATION

The case of study has been implemented during the year 2013 in several courses. In the first term, two *Introductory* courses to mobile technologies were taught to about fifty students. The second term, a new edition of *Introductory* course was delivered, and an *Advanced* course was included to cope with users that joined a previous course and wanted to improve their knowledge about these topics. Both courses were taught by the same lecturers in sessions of two hours by week.

A. Course delivery

The implementation of these courses has been based on a delivery method that mixed teaching in classrooms with learning experiences around the campus. This method allowed instructors to present basic concepts about mobile technologies in a controlled environment, as well as enabling activities in real scenarios outside the classrooms. An example consisted in visiting an outdoor sculpture exhibition that provided information as hot spots accessible from mobile devices. Figure 4 shows a picture that displays a sculpture sample and the QR hot spot used to support this learning activity.



Figure 4.- Sculpture hot spot.

Each course was delivered to about 24 students who attended sessions one day by week. Classroom sessions were taught in a special building prepared to receive multiple Wi-Fi connections. A slide projector was also used to teach basics about mobile technologies and present the different learning activities supported by them. A set of tablets and smartphones was available for course participants though many of them brought their personal devices. This circumstance is further analyzed because the complexity of dealing with a diversity of device configurations and the multiple questions asked by participants about it.

Another critical issue in the course delivery was the format of the documents that reported the technology basics and related activities. These documents were in electronic format (see Figure 3) but the lack of desktop computers in

the classroom led to instructors to provide printed versions of this documentation that helped course participants in their instruction. Activities proposed in the classroom were mostly developed as individual works though some of them, such as sending or receiving messages were performed by pairs or even, in groups through social networks applications. Eventually, these activities were checked in order to detect the personal course progress but avoiding a grading purpose.

B. Course evaluation

The evaluation was mainly focused on analyzing the perception of course participants. Previously, a study of some participants' attributes was performed to achieve a user profile in the several implemented courses. The analysis of user perceptions was organized in several items concerning issues, such as handiness of mobile technologies or their usefulness for course participants. A last aspect consisted in evaluating the user accesses to mobile applications through data logs provided by Android devices used in the courses.

The study of user profiles was carried out using a printed questionnaire fulfilled by participants at the start of the course. This questionnaire was divided in two sections: the first one addressed to get demographic data, such as the user age, gender, or their academic studies. The second one was oriented towards gathering some technical data related to the use of mobile technologies. The next list presents some of the demographic data collected:

- Most of course participant were female (62% in the first term of 2013 and 70% in the second one).
- More than fifty percent of users aged between 63 and 70 years.
- More than sixty percent of users had higher education.
- Three quarters or more were retired people.

The technical study is summarized in Figure 5 that shows some interesting statistics. For example, the percentage of course participants who had internet in their mobile phones was higher than 60% in the first term (2013a) This percentage increased in the next course (2013b) till 85%. In the same way, the percentage of participants who owned smartphone or tablet devices grew until 80% and about 65%, respectively during 2013. Also, the percentage of course participants who daily used their mobile devices in the course 2013b was near the double than the first term.

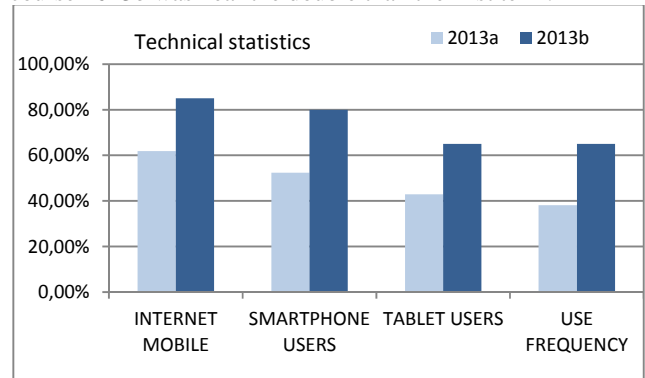


Figure 5.- User technical profile.

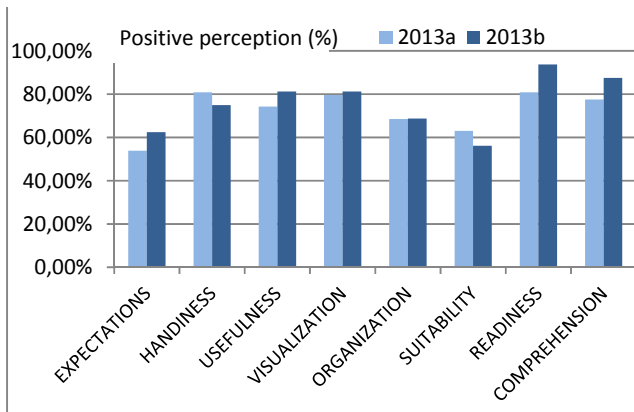


Figure 6.- User technical profile.

Figure 6 shows a bar chart that displays percentage statistics about the user viewpoints of the course. These viewpoints were gathered using an electronic form submitted to users at the end of each term and its answers were based on a Likert scale (from 1 to 5 being 5 the more positive valuation). The graphic view reveals some outcomes, such as the fulfillment of *Expectations* where about half of users stated a positive perception (a value higher than 3 in their answer) in the first term of 2013 and more than 60% in the second term. Higher percentages were drawn in issues, such as the *Handiness* to use mobile devices, their *Usefulness* or the ability to *Visualize* course documents. An aspect that provided a similar percentage (about 70% of positive valuation) was the perception on the use of mobile technologies to improve *Organization* skills.

A second question that was evaluated consisted in the analysis of the log accesses to the mobile devices used during these courses. Such logs were obtained through a *Logcat* tool that provided information about those Android services, which were run in the course activities. Figure 7 shows a sample of timing diagram that displays a sequence of Android events related to an e-mail activity.

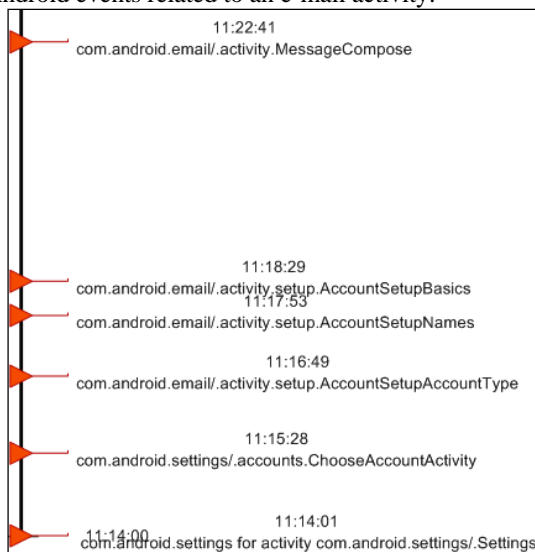


Figure 7.- Android service logs.

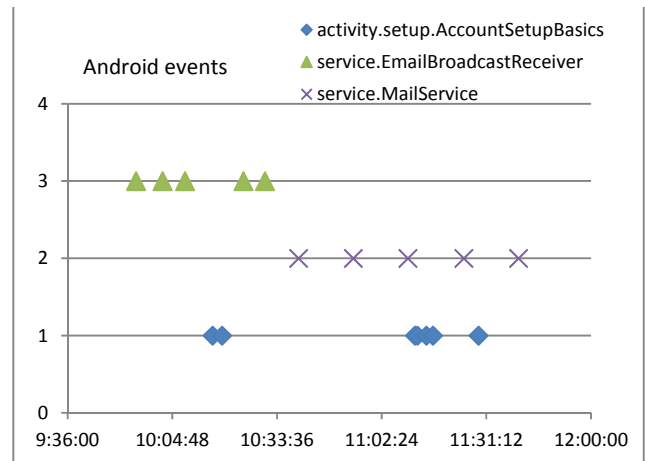


Figure 8.- Android access statistics.

This type of event tracking based on data logs enabled a deeper analysis of user behavior. In the current work, it allowed to measure the activity level of participants in the course when they were using mobile technologies. Such activity could be checked in order to test if the planned scheduling was met or get a performance index for each user. Figure 8 shows a chart that displays this kind of activity registering the timing of the Android events related to sending an e-mail in several devices. In this case, there is sparse distribution of events configuring the e-mail activity (*AccountSetupBasics*) regarding those events of type *MailService*.

C. Lessons learned

The evaluation of the case of study previously introduced has provided significant outcomes and lessons learned concerning the use of mobile technologies in specific scenarios of adult education. A first lesson is the need of a sound framework when learning processes are implemented within adult educational scenarios. This kind of framework is crucial when dealing with users who have different level of expertise and singular educational goals. The proposed framework has been based on a well-known instructional approach that fits quite well with the use of technologies in this type of scenarios. A key issue in such approach is the *Analysis* of the user learning requirements and the conditions that these users request. Mobile devices are relatively new technologies, especially for elder people, and it is important to gather their perspective in the knowledge of such technologies. Afterwards, it would be more suitable to adapt the *Design* of learning resources and teaching activities to these requirements.

This rigorous and systematic approach has also enabled the appropriate *Development* of educational media that fit technical features of mobile devices: The diversity of size and interface features makes difficult to develop instructional materials to be deployed in several devices (e.g., a tablet vs. a smartphone). Therefore, it is important to collect these media and label them to get a catalog of available material adapted to the required learning scenarios. That lesson led to elaborate a database of potential mobile devices that could be

used for adult education and the suitable resources for these devices. An additional lesson is focused on the mechanisms that can be deployed to deliver and supervise the use of mobile applications. There are several mobile platforms in the market and even within a specific platform like Android, multiple versions are available providing a different or customized display of applications. Moreover, users who brought their personal devices asked for tools to ease the access to these mobile applications.

Finally, there is a general agreement about the need to find new *Evaluation* tools that enable a deeper study of the user behavior when they interact with mobile technologies. Questionnaires provide a qualitative perception of the users' point of view but additional measures are required. In the current work, a *Logcat* tool was applied to track Android events in mobile devices though it was complex to manage the huge amount of collected data. Moreover, this type of tool is bounded to older Android versions. Alternative methods, such as eye tracking techniques and touch detection mechanisms could be explored to obtain new data sources in the context of adult education learning scenarios.

V. CONCLUSIONS

The current work has presented an instructional approach that permits to organize learning processes in a context of deploying mobile technologies. These technologies have been used to implement several courses during the year 2013 especially addressed to elder people. The proposed approach has shown its usefulness when implementing such courses since it provides a systematic way to analyze, design and develop learning resources and activities based on the use of mobile devices. A case study has been evaluated concerning two *Introductory* courses about mobile technologies and assessing their impact in the way elder people interact with such technologies. Several questionnaires have been delivered to gather profile information about users who joined these courses. At the end of each course, an additional questionnaire has been submitted to obtain the viewpoints of course participants. Also, data logs extracted from mobile devices deployed during these courses have been analyzed to check timing patterns in the use of mobile apps. The global analysis of the evaluation outcomes reveals a high interest of elder people about learning through this kind of technology although the data logs show the users' problems to follow planned activities.

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