Learning objects for mobile devices: A case study in the Actuarial Sciences degree

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In this paper, the educative possibilities of Java midlets, which are small applications that can be stored in a mobile phone, are explored in several courses in the Actuarial Sciences degree of the University of Málaga. This project is carried out by a multidisciplinary group of teachers who have been developing learning resources in electronic format during the last six years. We follow a flexible blended strategy that includes the traditional classroom, e-learning and m-learning elements. Thus, the students can customize their learning processes using the contents and the way of access they are more comfortable with or consider more effective.

Keywords m-learning, java midlets, mobile phone

1. Introduction

Although many elements of e-learning are becoming usual in the higher education system in Spanish universities, mobile learning based instruments are less frequent. In this paper, the educative possibilities of Java midlets, which are small applications that can be stored in a mobile phone, are explored in several courses in the Actuarial Sciences degree of the University of Málaga. This project is carried out by a multidisciplinary group of teachers who were developing learning resources in electronic format during the last six years, in order to provide on-line and off-line access to these resources to our students. Although the Actuarial Sciences degree of the University of Málaga is not a distance course, many of our students don't attend all the courses regularly, so we decided to develop new channels to communicate with the students and to deliver content.

Despite the spectacular growth of wireless phones and handheld devices, wireless e-learning and mobile learning, m-learning, are still in an embryonic stage [1]. Mobile learning is made possible by the convergence of Internet, wireless networks and electronic devices and e-learning. The specific features of the small wireless devices, including new mobile phones, provide several benefits to the m-learning process, like allowing students to use their spare time while travelling or waiting at public transports to finish homework or doing certain activities. In addition, the personalization capabilities of these devices have the potential to change the way students interact with their teachers and classmates.

However, the introduction of small wireless electronic devices into the learning pedagogy raises concerns among faculty regarding their usefulness in higher education [1]. Nonetheless, several studies [2, 3, 4] demonstrate the potential of m-learning applications in education. The experiences in these studies coincide in the use of a m-learn approach that complement an existing learning environment, and noticing that instructors must understand the limitations of mobile devices in order to develop appropriate learning pedagogies.

Based on the revision of the mentioned studies and in our own experience [4-10] we decided to integrate the new m-learning instruments into a flexible blended strategy that includes the traditional classroom, e-learning and m-learning elements. Thus, the students can customize their learning process using the contents and the way of access they are more comfortable with or consider more effective.

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2. Midlets for Java anabled phones in the Actuarial Sciences degree

The multidisciplinary team of teachers that are involved in this project follow a flexible blended strategy that is summarized in figure 1. This strategy integrates several of the elements (included in categories 2 to 5) present in the Sharples framework of five approaches for using technology in learning: (1) intelligent tutoring systems, (2) simulation and modelling tools, (3) system tools and resources, (4) communication aids, and (5) simulated classrooms [11]. The interaction between teacher and student takes places directly in the traditional classroom and in the PC laboratories of the Faculty. There is also interaction between them through electronic media, like e-mail, forum and chats. The contents are delivered by means of the University server. Therefore, the students can use several e-learning objects in their computers, the computers of the Faculty PC laboratories or even in their mobile phones.

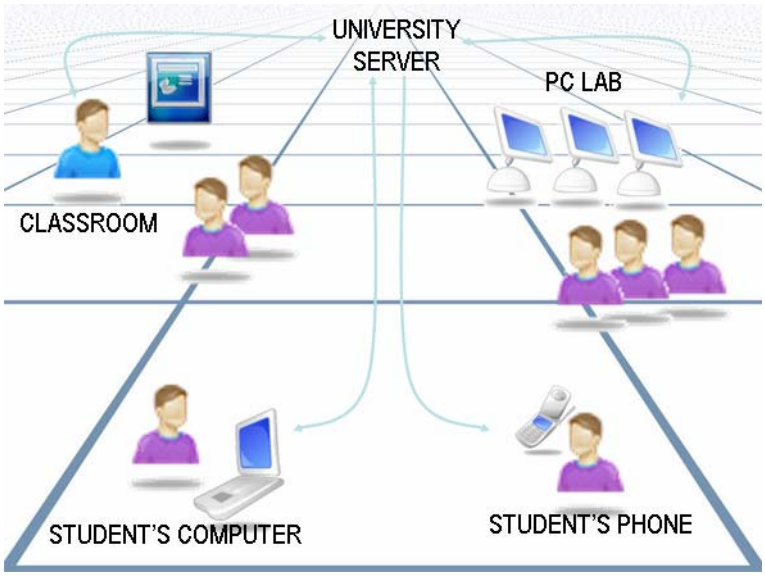

Fig. 1 *Flexible blended strategy.*

The m-learning objects that we have designed belong to Sharples categories (2) and (3). To take in account the limitations of the mobile phones, we designed deliberately small modules that can be used off-line. A previous survey carried out in the last course revealed that the majority of the students had Java enabled phones, and that the most wanted modules for this device were a) pedagogical assistants (exams calendar, tutoring hours), and b) small tests and frequent errors.

Taking into account these results we designed two basic midlets: an interactive test and an interactive module of frequent errors, which includes the correct answers. In addition to the test questions or the frequent errors, both midlets have a small menu with information of the course, tutoring hours, and exams calendar. Figure 2 shows an example of the menu of a middlet containing an interactive micro test. As mentioned above, the menu includes entries with general information about the course (name, teacher, web page, etc.), calendar (*fechas*), and tutor hours (*tutorías*).

Fig. 2 *Examples of two entries of the main menu of a midlet.*

The functioning of the test is exhibited in figure 3. Our tests contain only four or five short questions. Once a question is selected, the alternative answers are displayed and the student must choose one of them. To check if the answer is correct he/she must press the *Comp.* (check) key and a screen with correct or incorrect will be displayed for five seconds, after that the middlet returns to the alternative answers screen and the student can go back (*Atrás* key) to the main menu or try another answer if he/se was not correct.

The learning tools that we developed for the mobile devices use the J2ME Java programming platform, which almost all modern mobile phones are shipped with. A previous experience consisting of interactive tests delivered via WAP [5, 10] revealed that our students did not wanted to assume the costs of connection, and therefore we turned into the developing of applications that can be executed off-line. The midlets files are available via WAP, but they are also available in the virtual campus of the University of Málaga via Internet, so they can be downloaded to the student's PC and then transferred to the mobile phone via Bluetooth, infrared or cable. This second channel is the one preferred by the students.

Fig. 3 *Interactive test of a midlet.*

3. Conclusions

Mobile phones have become very popular among students in our universities. Although these devices are primarily used for speaking purposes, they may also be used as small computers and thus, their use in higher education as a new tutoring and communication medium can be very useful. The high degree of adaptivity and personalization of these devices can be educationally beneficial to students, especially in courses with insufficiently motivated ones.

However, some issues have to be taken in account in order to get pedagogically efficient applications. The limited capacity of the current mobile phones, small memory and little screens, makes necessary the design small applications, like the micro-modules we have proposed in this paper. In addition, as we have observed in other mentioned experiences, the small educative applications running on mobile phones can only reveal their potential if they are integrated into a more general learning strategy. In our case, we chose a flexible blended strategy that includes the traditional classroom, PC laboratories, e-learning instruments via Internet and m-learning instruments for the mobile-phone.

Finally, the Java J2ME platform has proved being a better way of delivering content than the WAP one for educational purposes in our project. Our students prefer the off-line execution of micro-modules (that are compiled into Java midlets) than the access on line to WAP pages, arguing that the first method avoids the payment of connection costs.

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