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PILOT PROJECT OF M-LEARNING

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Abstract

The article offers an insight into specific features of mobile e-learning (m-learning) in terms of technical implementation, available platforms and their related problems, and evaluates the practical experience. It also summarizes reasons for introduction of mobile learning and analyzes available options for its technical implementation. Specific example is used to demonstrate practical use of m-learning courses – learning of English language for a defined group of recipients within an international Leonardo da Vinci pilot project "M-Learning for the Young People (Students) at Risk Groups (MLARG)". Substantial part of the text is dedicated to the analysis of typical functions available in an m-learning system and to the discussion about its advantages, disadvantages and limitations, mainly in relation to the properties and features of conventional e-learning environments. The expected development of m-learning technologies is outlined in the context of modern learning methods.

Keywords

communication technologies; education process; e-learning; m-learning; MLE-Moodle; online courses

Introduction

The contemporary world is characterized by new technologies emerging in the area of electronic communications (Vaněček, 2008). It is obvious that many (more or less successful) attempts to implement and use these technologies in education, especially in electronically supported distance learning (or e-learning) occur. The development focuses mainly on the user segment, i.e. mobile terminals for voice and data communication, and we can observe the convergence of two worlds that were originally very different – the world of computer technology and the world of telephony. The practical result of this process is that computers are becoming smaller and smaller (keeping or even increasing their performance), while the size of mobile terminals, resolution of their displays and their computational power are growing. Therefore it is logical that many scientists and teachers ponder the possibilities of such easily portable devices, especially in relation to the needs of e-learning.

Distance learning with the aid of mobile devices is referred to as m-learning. The definition of m-learning is straightforward: "Any sort of learning that happens when the learner is not at a fixed, predetermined location, or learning that happens when the learner takes advantage of the learning opportunities offered by mobile technologies" (O'Malley et al., 2005).

Suitable Content

When considering the introduction of m-learning, we should focus on the question whether the content to be provided is suitable for presentation on mobile devices.

Generally, it is advantageous if the "pocket" educational activities are not time-consuming and can be interrupted at any time without any complications. These activities include e.g. flashcards (for learning vocabulary), short tests or brief parts of explanations. On the other hand, this form is not recommended for demanding activities in terms of means needed for displaying the content, i.e. animations, complex tables, large images, or any content consuming substantial part of the transmission capacity, including those activities that require writing of long responses by the users (which usually takes much time and is not very comfortable with mobile devices).

Relevant Target Group

Structure of the target group should also be explored before the implementation. Every specific target group will use different hardware and different approach to learning with the help of modern technologies. We should take into consideration whether the users are willing to sacrifice the comfort of a large screen in favor of mobility. The willingness to use mobile devices can be characterized by the graph in Fig. 1. The first section (1) comprises those users who are fully capable of controlling the respective device (especially small children); they are followed (2) by older children who master the device itself, but for some reason they do not use data transmissions; the curve reaches its highest point for teenagers (3) and young adults (4). Midlife people (5) prefer comfortable displaying and control (of bigger devices) to the capabilities of mobile devices (perceived rather as a substitute in case of need). The last group (6) is formed by elderly people that may have substantial problems with small screen size and tiny control elements, and therefore they are likely to avoid such solution.

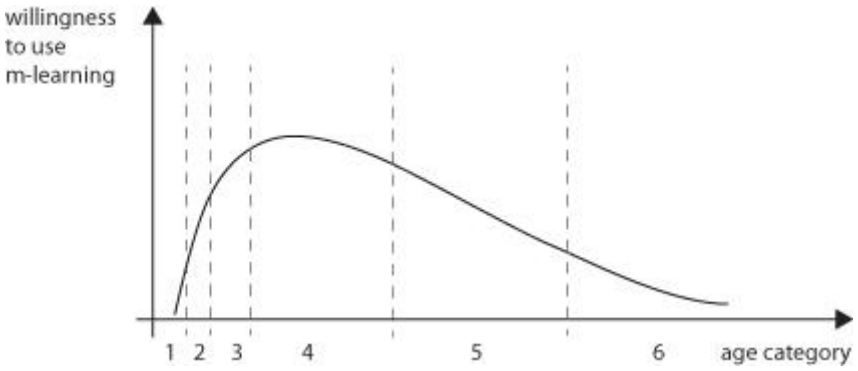

Fig 1. Attitudes changing with age

Education Objectives

Another important detail for implementation of a mobile learning system is the objective (i.e. what should be achieved) – the possibility of studying anytime and anywhere (with respect to the mobile device operation), or just a supplement to another type of education. Clarification of this objective is crucial for development of the learning content, as it must be optimized for the mobile terminal, which often brings on radical limitations that may be, after all, counterproductive in terms of efficient knowledge transfer.

Suitable Devices

The existence and availability of suitable terminal devices for the given target group is crucial for m-learning system implementation. Some parameters have to be based on a compromise. The elementary criteria include:

- large screen – offering comfortable reading and displaying of details;
- small dimensions – the device should be a "pocket" one;
- long operation on batteries;
- intuitive controls – e.g. touchscreens allow more precise navigation than a cursor controlled through keypad;
- data transmission – m-learning systems usually access the content stored on a remote server, using the client-server architecture. In such cases the satisfactory transmission capabilities of the terminal device are vital for proper function;
- appropriate software tools – hardware capabilities are just the first part, but software equipment is at least of the same importance (i.e. Internet browsers, multimedia players and their properties, etc.).

MLARG Project

Our department has been involved in the research and practical application of innovative pedagogical methods for many years, and therefore we eagerly accepted the offer to participate in a European lifelong learning / Leonardo da Vinci project "M-Learning for the Young People (Students) at Risk Groups (MLARG)" (http://mlarg.boun.edu.tr), coordinated by Bogazici University (Istanbul, Turkey), with partners in Italy, Slovakia and the Czech Republic. The aim of the project is to use mobile learning technologies to design language (English) teaching materials and methodology for young people (ages 16–17) with limited financial resources studying at vocational secondary schools. The main reasons for choosing mobile learning are the following:

- m-learning helps learners to develop positive attitudes towards literacy in both school subjects and technology;
- m-learning motivates learners to take part in activities in mobile medium of communication via multimedia tools, such as mediaBoard, portal page, and video clips;
- m-learning allows "personalized" learning "anywhere" at "anytime" for everyone with only a very basic equipment.

From the pedagogical and didactical viewpoint, the inclusion of mobile technologies is a new feature. Therefore it is necessary to design the technical implementation together with suitable procedures and methods that would make use of the specific properties of this solution; on the other hand, any procedures in which the use of mobile terminals would bring more difficulties than benefits (compared to traditional e-learning) should be limited or even eliminated.

Available Client Platforms

In principle, the application of m-learning can be based on either of the following technologies:

- Java application;
- Web browser.

Java application is a piece of software that is installed in a mobile terminal. The learning process uses an off-line approach and the method does not support full range of interactive elements. There is only limited communication with the server, and only the most important data is transmitted (usually in small batches), e.g. answers to test questions.

The principle of the "Web browser" approach is based on the traditional server-based solution. The complete learning system (specific type of learning management system (LMS)) is installed on a remote computer. Trainees access the services provided by the remote computer through a standard web browser installed in their mobile terminal device.

The latter (web browser) offers more advantageous, flexible and universal solution.

The advantage is that the look and/or content of the pages can be easily altered (on the server side) and there is no need to update the local software in the remote terminal (unlike the Java application). It should also be noted that the web pages work without limitations on different types of terminals (at present time, for example, it is relatively complicated to use Java applications on the iPhone platform, and different versions of Java introduce various unexpected problems as well).

The disadvantage is that the user interface may be slightly different for different types of browsers (similarly to non-mobile terminals). It may also be considered a specific disadvantage that this approach requires an on-line connection with higher volume of transmitted data (compared to the solution employing a Java application). Although caching in the memory of a mobile browser is possible, it is still necessary to transmit more data than the current operation requires. From the viewpoint of logic, the browsing through the learning content is entirely controlled by the server. For example, when the confirmation of a correct response in a test is transmitted towards the user, other content is always transmitted as well, e.g. change of a button pointing to the next question. In that case, the browser's cache (in the mobile device) is used only for (e.g.) images or other related files (such as definitions of cascade styles).

Implementation

The selected technical implementation requires an LMS system installed on the server side, having the support for mobile devices already built-in, or employment of other learning system that allows such option to be added. For the purposes of the MLARG project we have chosen Moodle as the learning management system.

There were several reasons for this choice: we know the capabilities of Moodle LMS, its wide use, openness, favorable licensing conditions and the existing (and modifiable) support for displaying content on mobile terminals. The purpose was to preserve (to the largest possible extent) the option to study the learning content in the same GUI that is used on standard computers.

It is vital for the success of m-learning implementation to provide the users of the courses with a comfortable and friendly GUI. The original Moodle system is not suitable for devices with small displays. Therefore we have decided to use the MLE (Mobile Learning Engine) plug-in, which helps to optimize the learning content for presentation on mobile devices, organizing it into the format of relatively narrow columns.

As the recent version of MLE did not meet all requirements given by the nature of the considered courses with respect to the proper presentation of their content, we have started adequate modifications of the MLE source code, so that it becomes more compatible with the project objectives. In some details it was necessary to modify Moodle itself.

The implementation of the mobile solution is based on these key project objectives:

a) motivation of students to learn through presentation of the learning content in an attractive form;

b) the given topic, i.e. English language for professional schools in tourist industry.

Pilot Course

We have prepared an operable version of six exemplary courses. They are relatively short and their main purpose is to verify specific functions of MLE-Moodle as well as the m-learning methodology. The courses can be accessed at http://mlarg.cvut.cz/mobile (version optimized for mobile terminals) or http://mlarg.cvut.cz/moodle (PC-compatible version for reference purposes). The following topics of the courses are currently available:

- restaurant;
- tourist information office;
- check-In;
- at the travel agency;
- destinations;
- on the tour.

The target group involved in the pilot testing is composed of students at secondary schools specializing in tourist industry, and the particular objective is learning English language with the emphasis on specific situations and their corresponding vocabulary.

Implemented Functions

After logging in and entering the homepage of the courses, the system displays a screen containing the list of available courses and the upper navigation bar (see Fig. 2). The user interface and its functions are based on standard Moodle version, but some features are not available.

The overview of specific types of exercises can be seen in Fig. 3. The type “Listening for gist” consists of listening to an audio file, after which students pass a simple test (e.g. single-choice out of three options) verifying whether they have understood the meaning of the message. The “Listening for specific information” is a similar type of exercise, verifying whether the listeners also understand particular details of the message. In these tests students are usually given two attempts, and if both answers are wrong, then the correct response is eventually displayed.

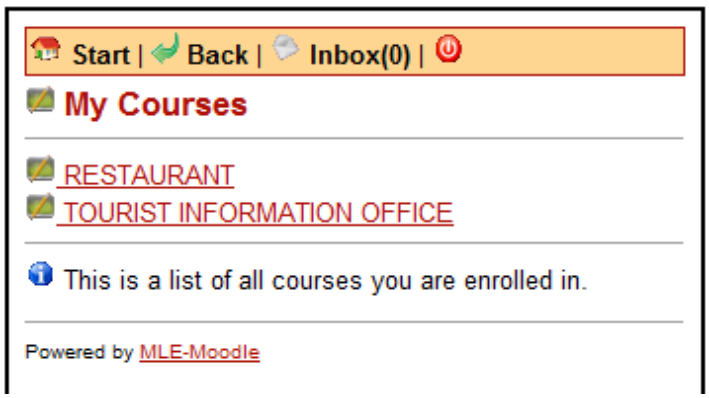

Fig 2. Initial page

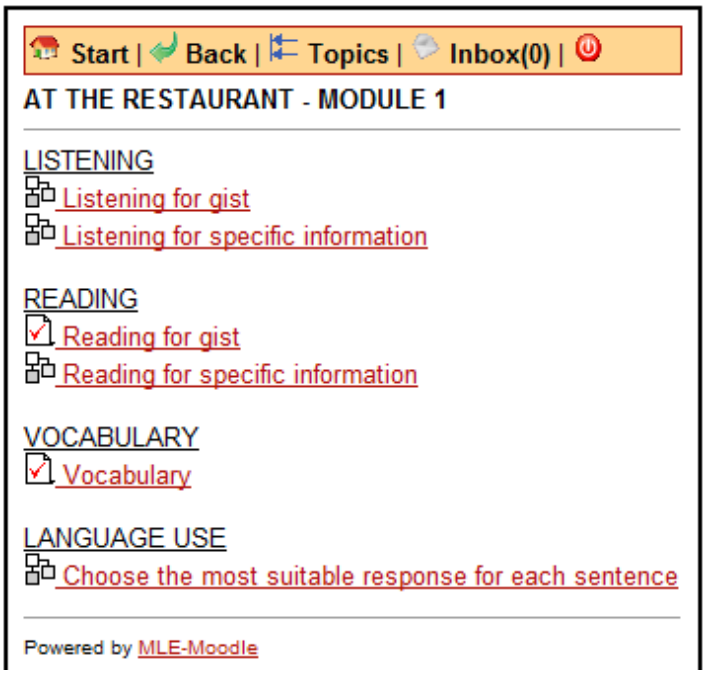

Fig 3. List of exercises (various types)

The exercises of "Reading for gist" type are focused on the understanding of written texts. The question is in the textual form, and students are offered only one attempt to answer. "Reading for specific information", similarly, focuses on searching for specific information in a text. Individual questions are displayed successively, and a wrong answer cannot be corrected. The total numbers of correct and wrong answers are summarized at the end.

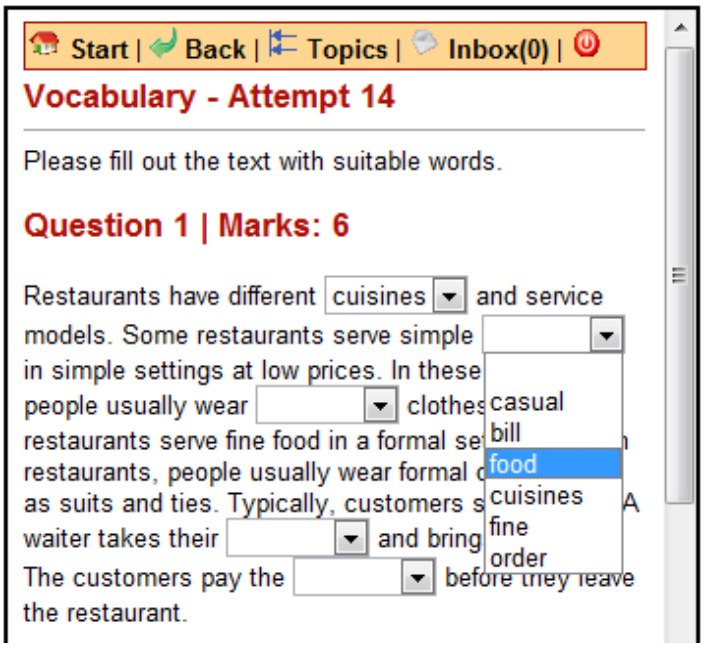

Fig 4. Specific type of exercise ("Vocabulary")

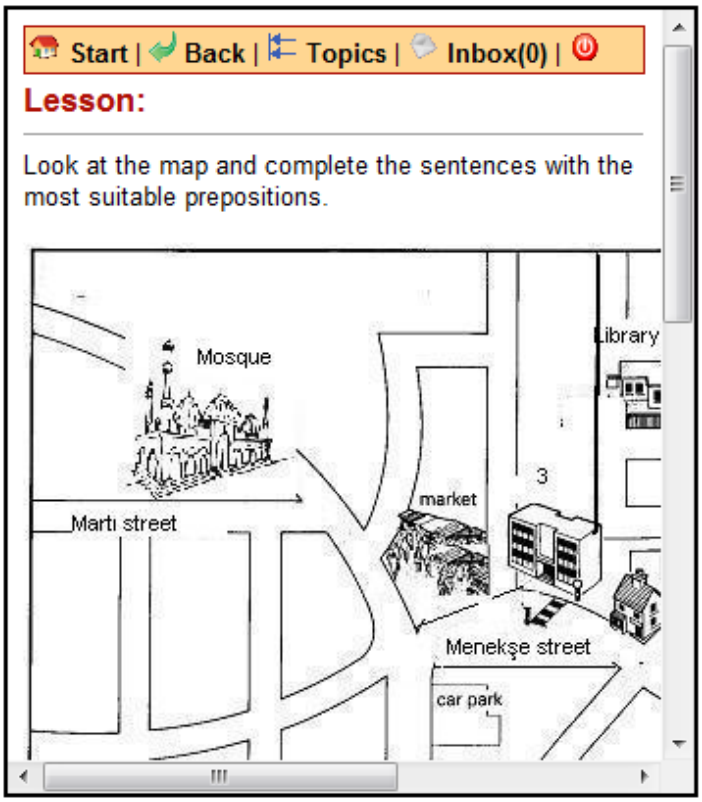

Fig 5. Displaying a large picture

The "Vocabulary" exercises (see Fig. 4) are, as we could expect, intended to practice the vocabulary. The individual tasks consist of sentence completing (choosing one option from a limited range of expressions) and of assigning corresponding words to pictures.

One of the major problems is the displaying and viewing of large images. As the display area is limited, there are basically two solutions coming into consideration:

- Displaying of the entire image in a reduced size (which introduces the risk of poor readability due to its small dimensions), or
- Viewing by parts, changing the displayed area with the help of horizontal and vertical scrollbars (which might be difficult to get oriented in).

MLE-Moodle uses the latter option (scrollbars), as illustrated in Fig. 5. The picture is displayed in its original size, but users have to move over it. However, modern devices with multi-touch screens make resizing and moving very easy.

The last frequently used type of exercise is "Language use" – practicing understanding of the language. Different types of questions are available for testing. This type of exercise is included at the end of every module or lesson.

The developed learning content also includes videos (see Fig. 6). A specially prepared video server was implemented within the system. Video sequences are uploaded to the server and then automatically converted to a format suitable for mobile devices (we have chosen MPEG-4). With respect to the limitations of other supporting technologies (such as Adobe Flash) we have decided to use displaying through the HTML5 standard; however, this solution introduces a demand for an advanced web browser installed in a mobile terminal. Video can be played directly from the displayed web page, but in a mobile device a proprietary solution for video

playback is often implemented. When a request for video playback is indicated, the integrated playback method is used (e.g. pre-installed Real Player). In the same way we can encounter similar problems with the playback of external audio files. Also, incompatibility may occur between (usually user-installed) web browsers and integrated media players (for audio and/or video content).

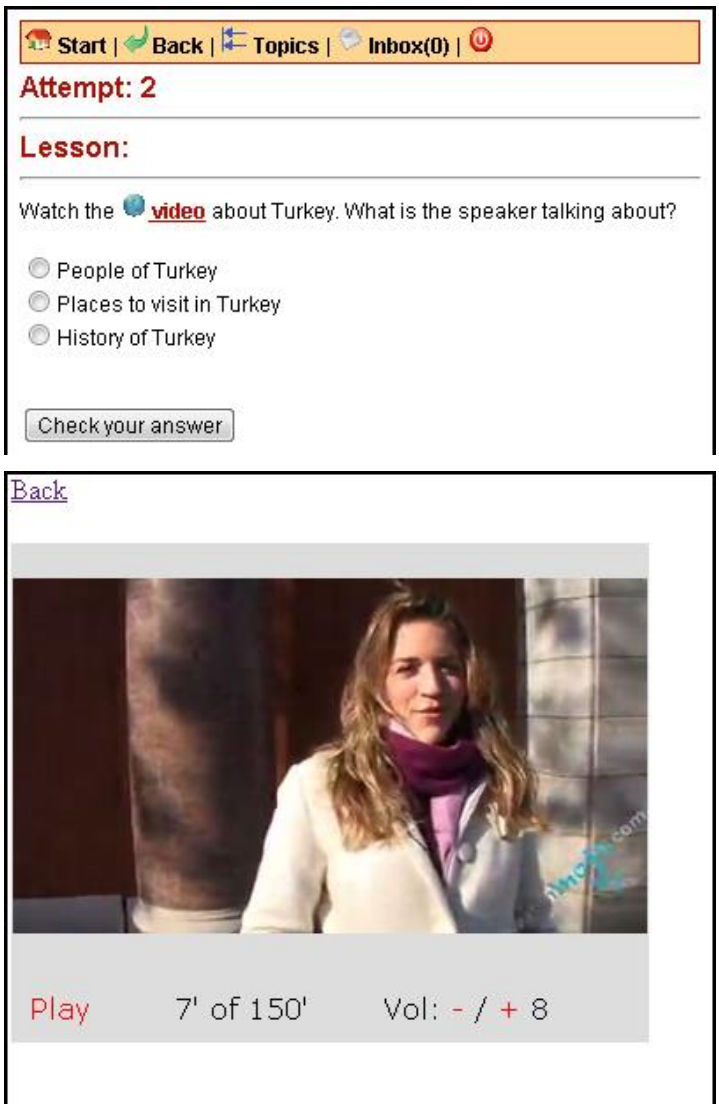

Fig 6. Video playback

Two different types of learning activities were the most frequent ones in the course of MLARG learning content development – Lesson and Quiz. It was necessary to choose the type of activity also with respect to the required feedback.

Lessons were employed mainly for tasks with multiple attempts, with different feedback for each single attempt.

Fig 7. Feedback after the first attempt

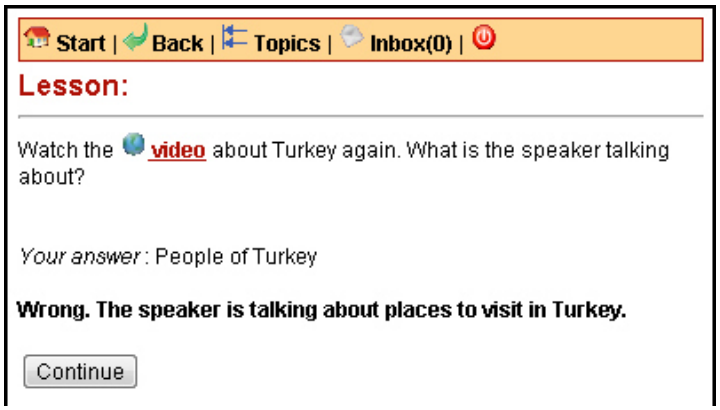

Fig 8. Feedback after the second attempt

If unified feedback was satisfactory – regardless of the number of attempts – we used the Quiz activity (see Fig. 9).

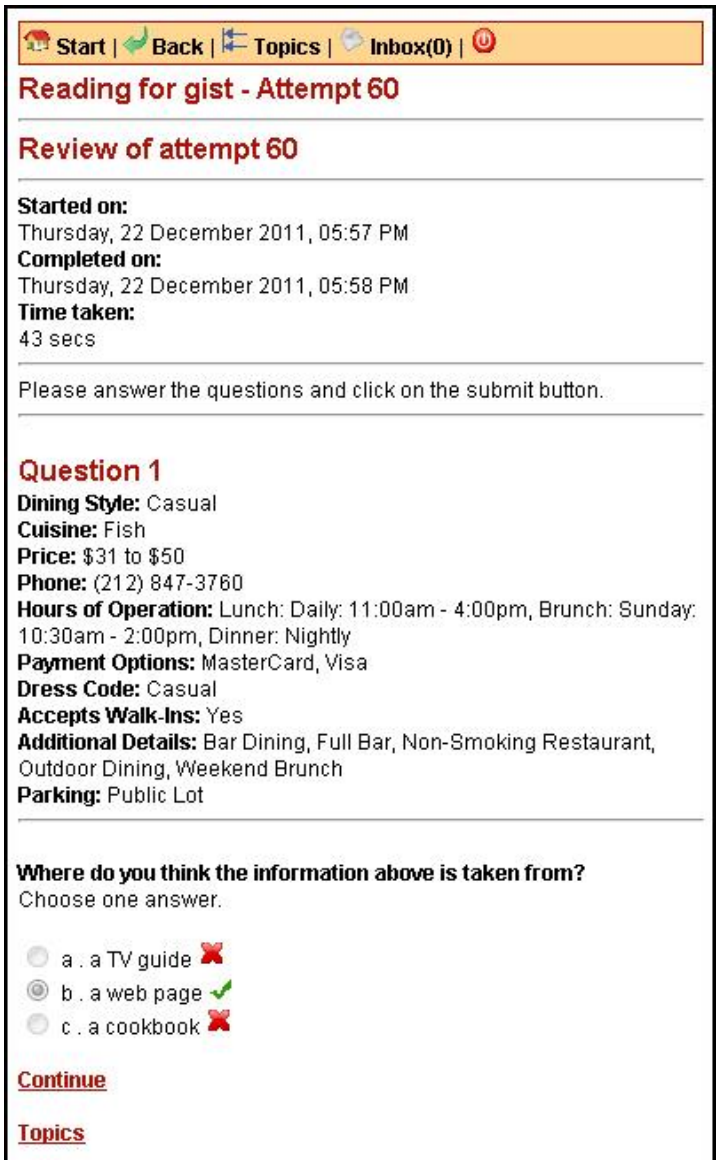

Fig 9. Unified feedback (Quiz)

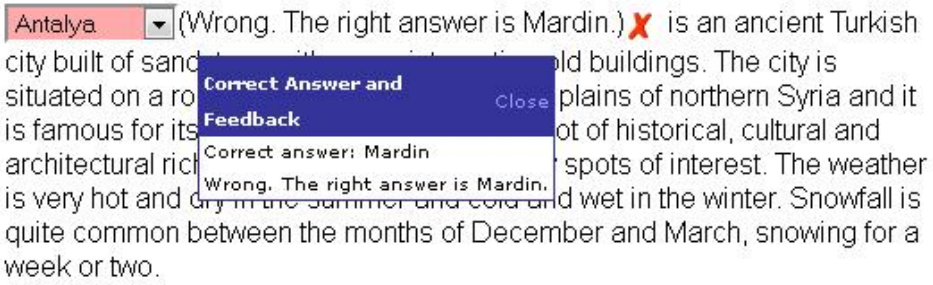

Fig 10. Feedback in Cloze-type tasks as displayed in Moodle with implemented changes in the code

For a Cloze-type question (within a Quiz activity), traditional Moodle displays feedback using the technology for displaying an additional HTML element on a page, after moving the cursor to the user's response. This HTML technology is usually not supported by mobile web browsers. The solution was found through the modification of the MLE extension and of

Moodle itself; the feedback is displayed as an additional text following the user's response (see Fig. 10 and 11).

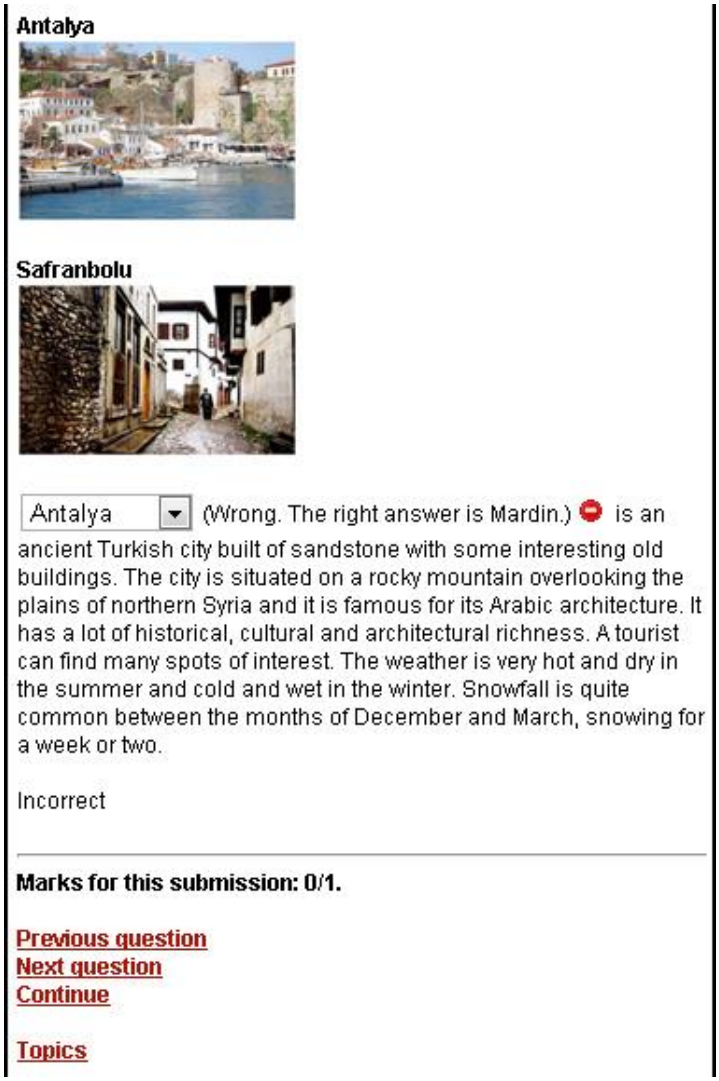

Fig 11. Feedback in Cloze-type tasks as displayed on a mobile device

Platform-related Issues

As for the communication between students (and their teachers), usual tools common for Moodle system (chat, discussion forums, and direct messages) are available.

We have encountered some problems related with the presentation of multimedia content, caused by the wide variety of operating systems used in mobile terminals and by a different level of (different) web browsers integration.

For example, Android 2.2 operating system (Samsung Galaxy i9000 S) cannot play MP3 content delivered from Moodle server directly – the file must be first saved to the memory of the phone, and then opened by the associated application. On the contrary, in Symbian OS version 9.3 (Nokia E72) or 9.2 (Nokia E66) a link to such file works correctly – but only in the integrated web browser; the attempt to use Opera Mobile 10.1 (for Nokia E72) for direct opening of multimedia files was unsuccessful and, moreover, direct link to the MP3 file did not

help in this case. Windows Mobile 6.5 (HTC TouchPro 2) with Opera Mobile 9.7 browser did not have any problems and the link was working properly.

In Android operating system, the described problem is caused by passing the file to the web browser. The workaround in this case is to use a direct link to the MP3 file, outside the course (then it is interpreted correctly), or to set file downloading in Moodle so that the browser is sent data content respecting the specific features of these browsers and devices.

The initial page allows users to download Java MLE application. However, we consider this option to be just an alternative, as identical operation on different types of mobile terminals cannot be guaranteed. Moreover, the Java application also has occasional problems with access to multimedia content.

Feedback Evaluation

During the first phase of the pilot testing we have obtained a valuable feedback that may help us to make system improvements. Let's quote some most interesting comments.

"Around 15-20 minutes of instruction were sufficient to learn the system basics."

"Studying the same content with a desktop computer would be more efficient."

"There is no big difference studying on desktop or mobile phone."

"Working on a small screen (4 inch) is a problem."

"Devices like iPad (10 inch) would be much more effective."

"My finger is so thick that I cannot easily activate the right button."

"With an incorrect touch, I find myself out of the system."

"My eyes get tired", "Intensity of the screen light is dim."

"A word puzzle may be helpful to teach vocabulary."

From these responses we can see that users generally tend to compare m-learning with their experience from conventional platforms. Logically, they consider personal computer to be more comfortable in terms of ergonomics – specifically, displaying and control capabilities; nevertheless, some of them realize the advantages of mobility and welcome modern types of devices, such as tablets that offer larger screen with higher resolution than ordinary mobile phones or smartphones.

On the other hand, most of the users were satisfied and there were no explicit complaints about content quality or suitability, access to the server, or any difficulties concerning the usability of mobile learning platform. In other words, the system appears to be intuitive and well usable for the tested target group, and therefore it is reasonable to assume that other groups of users would have no substantial problems as well.

Conclusion

The completed pilot run of the courses should give the answer to the basic question: Is m-learning a suitable complement of the electronic form of education, or is it just a modish matter to be overcome and then abandoned? (Vaněček, 2006) Therefore the feedback obtained from the course participants and their willingness to use the individual learning objects on a regular basis (if any, to what extent) is crucial for the future employment of this technology in regular education.

We can envisage that the m-learning technologies will become useful mainly in those fields where the learning content can be presented in a visually simplified form (with the emphasis on reduced volume of textual information). Typical examples of applications include various drill learning methods (vocabulary, phrases, filling of correct words into sentences, applications supported by instructions spoken from a mobile device, single-choice from several options, etc.). On the other hand, we expect lower interest in m-learning applications that require reading of many texts, filling of numerous forms or frequent movements on the screen of a mobile terminal device, such as solving complicated tasks, assignments requiring schemes, diagrams, graphs or videos, tasks for which users need to compile context-based information from different sources, etc.

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References

Mobile learning at risk groups. [online]. [Accessed 2011-10-21]. Available at: http://mlarg.boun.edu.tr.

O'MALLEY, C., G. VAVOULA, J. P. GLEW et al. *MOBIlearn Project Report: Guidelines for Learning/Teaching/Tutoring in a Mobile Environment* [online]. United Kingdom, 2005 [Accessed 2011-10-21]. Available at: http://www.mobilearn.org/download/results/public_deliverables/MOBIlearn_D4.1_Final.pdf.

VANĚČEK, D. *Informační a komunikační technologie ve vzdělávání*. Praha: ČVUT, 2008. ISBN 978-80-01-04087-4.

VANĚČEK, D. *Progressive Education Methods. New trends in engineering pedagogy*. Praha: ČVUT, 2006. Workshop of the International Society of Engineering Education IGIP. ISBN 80-01-03459-3.