A General Classification of Mobile Learning Systems

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Abstract: *The mobile education became more popular and accessible worldwide. Today there is a big variety of solutions for such systems. In this paper a general classification of existing mobile learning systems is made. A 3D visualisation of this classification according to three indicators of the usability is presented. It gives a possibility easy to take into account the differences in the implementation of the systems as well as their common characteristics.*

Key words: *Mobile Learning, Education.*

INTRODUCTION

The mobile learning is based on the use of mobile devices (pocket size computers (PDAs), cell phones, smart phones, notebooks or Tablet PCs) anywhere at anytime [4]. These devices must support wireless technology and have a possibility to present teaching materials, and to realise an asynchronous/synchronous communication between learners and teachers.

The existing wide range of mobile devices and wireless technologies gives an opportunity to realise different systems for mobile education. For example some of these systems can be used only in the area of a university or company, as at the same time other systems ensure a broader usage outside the educational institutions. Some of the systems support user access only to the administrative information, while other systems support an access to educational materials.

In the literature there are various classifications of mobile learning systems. These classifications concern: support of mobile devices, usage of wireless communication technologies, the possibilities to access the required information and the type of this information. The known classifications often apply one or two indicators, which concern the information, communication or education technologies used in the systems.

According to the information and communication technologies (ICT) the systems are classified by the type of mobile devices (Notebooks, TabletPCs, PDAs, cell phones or smart phones) and the type of wireless communication technologies (GSM, IEEE 802.11, Bluetooth, etc.) which they support. One of the technical classifications written in the literature [9] uses two indicators – the portability of the devices and the personal use ability.

The classification regarding educational technologies is made in relation to the supported information and the method to access it. According to this classification the mobile learning systems are divided in several groups. For example, in the literature sources [1, 10] the systems are classified in respect to the abilities to support on-line and/or off-line access to the learning materials. In [6, 11] the systems are classified according to the user abilities to reach learning materials in the university area (on-campus) or outside university (off-campus). In [2, 7] the systems are divided regarding the information connected to the educational process they support – learning and/or administrative.

The existing classifications have big disadvantages since they don't include the whole variety of different systems and don't correspond to their progress. These classifications also don't account for the complexity of modern mobile learning systems and the support of e-learning standards and specifications.

An attempt to generalise and to classify the main types of the existing mobile learning systems is made in this paper. A 3D visualisation of this classification according to three indicators is presented.

LAYOUT

In the literature source [9] the mobility is examined from the viewpoint of the portability and personality. Since each mobile learning system supports the use of mobile devices and wireless communicational technologies the authors suggest a general classification which considers systems which support devices belonging to the first (marked) quadrant of fig.1 [9] and are portable and personal at the same time.
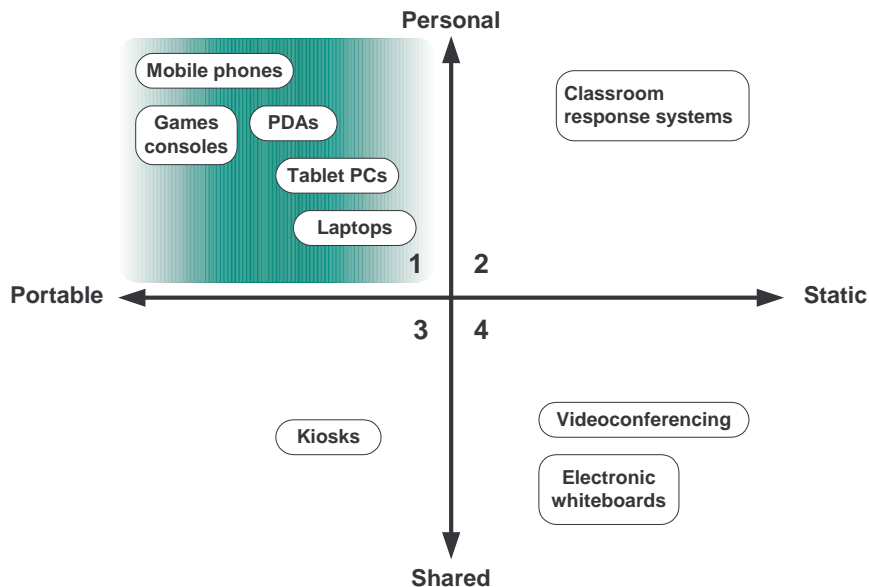

Figure 1. A mobile technologies classification [9]

Our classification (fig.2) covers the existing classifications and adds two more – according to the support of e-learning standards and according to the communication between students and teachers. The proposed classification gives a possibility to evaluate the varieties of realisations and requirements to these systems – ICT (mobile devices and wireless communication technologies) and educational (the type of supported information and the access method to it).

According to the information and communication technologies the proposed classification is based on the following main indicators:

- the type of supported mobile devices - notebooks, TabletPCs, PDAs, cell phones or smart phones;

- the type of wireless communication which is used to access learning materials and administrative information - GPRS, GSM, IEEE 802.11, Bluetooth, IrDA.

According to the educational technologies the proposed classification is based on the following main indicators:

- support of synchronous and/or asynchronous education;

- support of e-learning standards;

- availability of permanent Internet connection between the mobile learning system and the users;

- location of the users;

- access to learning materials and/or administrative services.

According to the time when the teachers and the students share information with each other the mobile learning systems can be classified as follows:

- Systems, which support synchronous education. These systems give the ability to students to communicate in real time with teachers and other students. More often for this purpose voice communication and chat are used. More rarely a video communication is used.

- Systems, which support asynchronous education. In these systems the students can't communicate in real time with teachers and other students. More often e-mail and/or SMS are used to send asynchronous information.
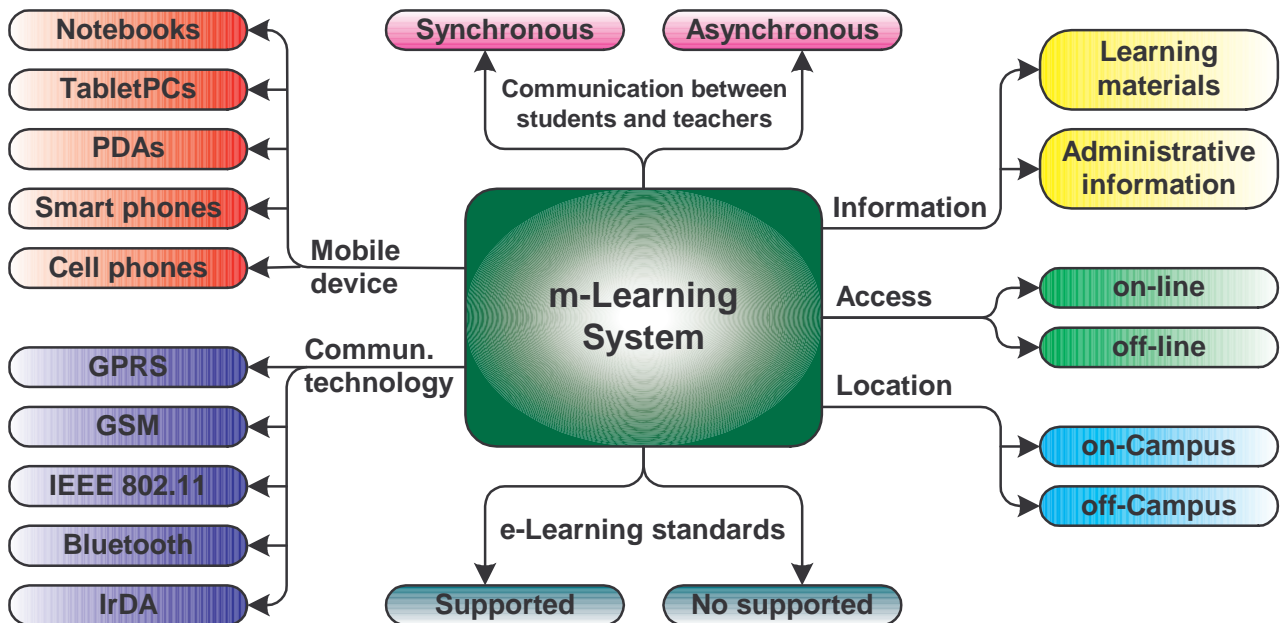- Systems, which support synchronous and asynchronous education.

Figure 2. A general classification of m-learning systems

At present there are no m-learning specifications and standards. This is the reason to include in our classification the indicator about support of e-Learning specifications and standards. According to this the m-learning systems are divided in:

- M-learning systems which don't support e-learning specifications and standards (SCORM, AICC, etc.). At the present time the main part of mobile learning systems (Mobile Education Platform [5], WELCOME [8], University Mobile Portal [17], etc.) belongs to this group.
- M-learning systems which support e-learning specifications and standards. To this group can be added some e-learning platforms (Blackboard [14]) which support e-learning standards and have a module for mobile learning.

The proposed classification according to educational technologies examines mobility as access to learning materials and administrative services with the dependence on the location of the users and permanent Internet connection availability.

Depending on the necessary of permanent Internet connection between the mobile learning system and the users to reproduce the teaching materials on mobile device the existing mobile learning systems can be divided in the following way:

- Systems for on-line mobile learning. These systems require permanent communication between the system and users' mobile devices. Such systems are for example Mobile Quest [15] and Learner Support System [20].
- Systems for off-line mobile learning. The learning material is uploaded in the users' mobile device. There is no need of wireless communication between mobile learning system and mobile devices. University 360 Mobile [16] and Agilix Mobilizer [18] are examples for such type of systems.
- Systems, which ensure both on-line and off-line mobile learning. The access to the part of the learning materials is on-line while the access to the remaining materials is off-line (they first must be uploaded to the memory of the mobile

devices). Next Move [13] and Mobile ELDIT [12] are some of the systems which support such type of mobile learning.

Depending on the location of the users the existing mobile learning systems can be divided to three groups:

- On-campus systems, which can be accessed inside the universities, schools and companies. The typical access to such system is by using laptop computers or Tablet PCs and via wireless network of the educational institution. The systems Mobilizer and Navowave [19] support Tablet PCs and laptops and can be attached to this group.

- Off-campus systems, which can be accessed outside the universities, schools and companies. The access to these systems is realised by pocket size computers (PDA), cell phones or smart phones as these devices support long distance wireless communications and offer more mobility than laptop computers and Tablet PCs. The University Mobile Portal [17] is an example of such type of system. It has the abilities to send SMSs containing news and important messages to the users' cell phones.

- Systems, which can be accessed both from inside and outside the educational institutions. The main part of the existing mobile learning systems can be attached to this group - Mobile Education Platform [5], WELCOME [8], Mobile ELDIT, Learner Support System.

Depending on the access to learning materials and/or administrative services existing systems can be divided to the next three groups:

- Systems for mobile learning which support an access to the educational content – materials, tests, dictionaries, etc. To this group belong systems like MobiLP [3], Next Move, Mobilizer, Navowave, etc.

- Systems for mobile learning which support an access to the educational administrative services. Such systems can send SMSs concerning the educational process (changes in timetable, marks of exams, etc.) to all students or to group of students. The example of such system is Mobile Quest.

- Mobile learning systems which support an access to the learning materials as well as access to the educational organisation administrative services. The system of this type is WELCOME.

One can see that the same system can belong to different groups. This depends on the classification indicator and the system's characteristics. The appropriate way to present a three-indicator classification is to use 3D diagram. In this diagram the last three educational indicators of the classification are marked on the 3 axes (figure 3). On the opposite side of any axis the opposite characteristic of the specific indicator is marked. In this way any system has exactly defined place depending on its educational characteristics.

On the horizontal axis X systems, depending on the type of the connection to the teaching and administrative materials they support, are arranged – on-line or/and off-line. In the middle of the axis X are the systems which support two types of connection. On the axis Y are arranged systems, depending on the location to connect to the teaching and administrative materials they support – inside the area of educational institutions (campus) or outside them. In the middle of this axis are the systems which support two types of location. Together axis X and axis Y make a plane on which systems with six different characteristics can be disposed. On vertical axes Z mobile learning systems are arranged depending on if they support access to administrative or teaching materials. In the middle of this axis are the systems which support these two types of services. Together axes X, Y and Z make a 3D orthogonal system on which systems with nine different characteristics can be arranged.
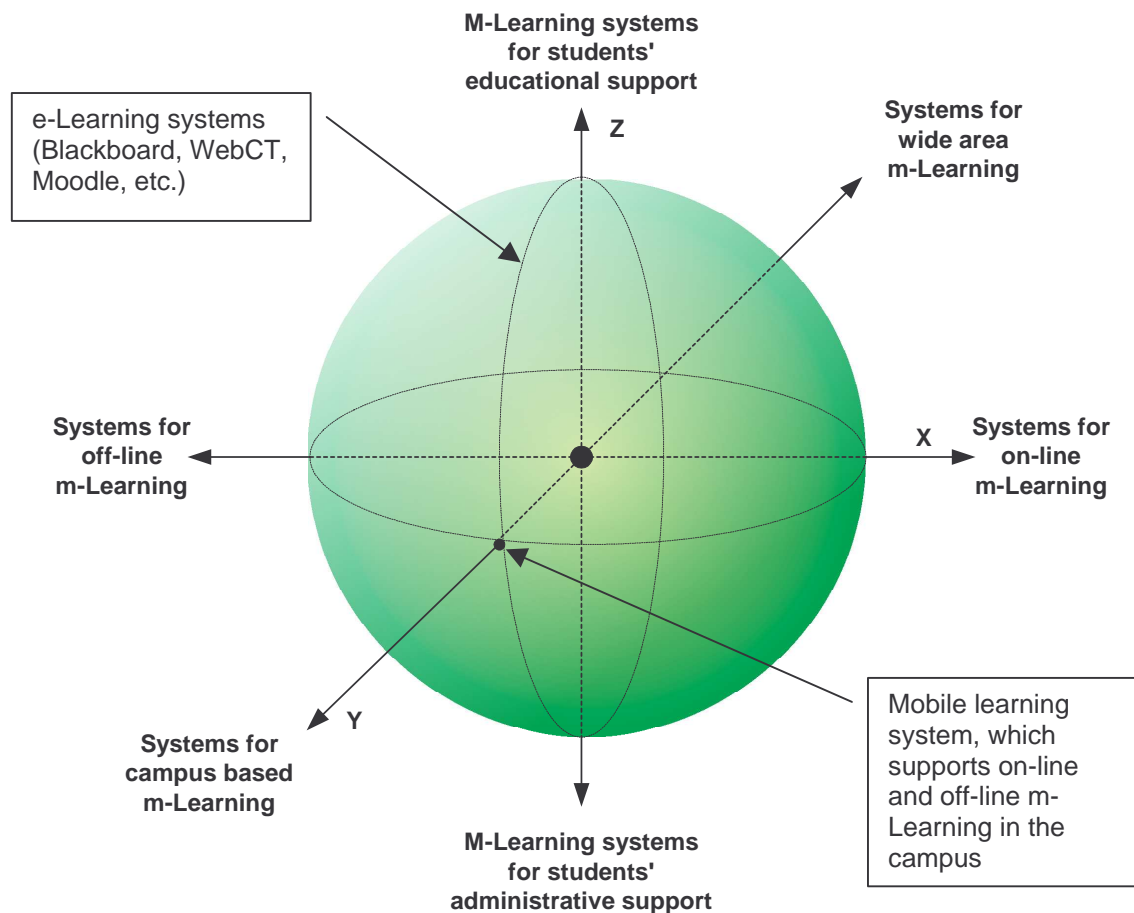
Figure 3. A 3D diagram of mobile learning systems classification according to 3 indicators

The best systems according to the current educational technologies belong to the centre of the sphere. These systems support all three types of mobile learning.

Some popular e-learning systems - Blackboard, WebCT, Moodle, etc. [14] in particular can be used for the purposes of mobile learning through universities wireless networks and Notebook computers. In our 3D diagram such systems belong to the front hemisphere, because from one hand they can support on-line and off-line learning, and from other hand they can give access to learning materials and administrative information.

CONCLUSIONS AND FUTURE WORK

The progress of the information and communication technologies will lead to wider use of mobile learning systems in the educational process. At the same time these systems will become more complex. The proposed classification and 3D visualisation give the possibilities to easily take into account the differences in the realisations of the systems as well as their common characteristics.

The future work of the authors will be connected to the design and realisation of a mobile learning system, which is to be used in the University of Rousse.

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