

A Comparison Analysis of Mobile Learning Systems

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Abstract: *With the progress of ICT the abilities for organizing of mobile learning increase more. At the present there exist mobile learning systems which differ from each other by their functional abilities. A well-founded selection of comparison criteria and comparison analysis of 12 mobile learning systems are presented in this paper. Appropriate conclusions about the main characteristics of the existing non-commercial and commercial m-Learning systems are made.*

Key words: *Mobile Learning, Education.*

INTRODUCTION

Today the more and more rapid development of the ICT contributes to the increasing abilities of the mobile devices (cell phones, smart phones, PDAs, laptops) and wireless communications, which are the main parts of the mobile learning. On the other hand for the implementation of mobile learning it is necessary to use a corresponding system for the management of such type of education.

In the literature sources there are many comparison analyses of existing e-Learning platforms [2, 5, 10, 13, 14, 21]. In the publications concerning mobile learning there are mainly surveys of different development solutions but there is no comparison analysis of the systems' abilities. In [7, 9] several big mobile learning research projects are examined - MOBILearn, M-Learning Project, From e-Learning to m-Learning, etc. There are descriptions of the projects' purposes, the target groups, the mobile devices which can be used but there is no sufficient information about the concrete technologies used for their development. The comparison of different mobile learning systems is a difficult task because this form of education is in its infancy and today there exist a little number of successful implementations, for which enough published information can be found.

The solution of this task is reduced to substantiate the choice of mobile learning systems comparison criteria. Using these criteria an analysis of the abilities of existing systems has to be done. Such analysis will significantly contribute to the future development of m-Learning systems.

LAYOUT

1. Existing criteria for comparison of e-Learning systems

In the literature sources there are many comparisons of e-Learning systems. Some of them compare two existing platforms. For example [2] describes the comparison between the Moodle and Blackboard e-Learning platforms. In [21] a comparison between WebCT Vista and Blackboard is given, which are the most known and used platforms for on-line course delivery. In other publications a comparison and the abilities analysis of more than two e-Learning platforms is made [5, 10]. Also on Internet there are sites which give to the user an opportunity to choose criteria and to compare many platforms (Moodle, Blackboard, Angel, WebCT, etc) [13, 14]. Such examinations and analysis enable users to choose the most appropriate platform corresponding to their needs. The comparison criteria can be combined in three main groups depending on the system's abilities:

- **Support Tools:**

- System and Administration Tools (authentication, course authorization, registration, etc.);
- Course Development Tools (instructional standards compliance, instructional design tools, content sharing/reuse);
- Course Delivery Tools (course management, student tracking, automated testing and scoring, etc.);

- **Learner Tools:**
 - Communication Tools between learners and teachers (discussion forums, e-mail, chat, video services, etc.);
 - Productivity Tools (help, searching, off-line/on-line work, etc.);
- **Technical Specifications:**
 - Hardware/Software (server, operational system, database, client browser, etc.);
 - Pricing/Licensing.

All modern e-Learning systems have abilities which cover the first two groups of criteria. The differences between them can be observed in respect of the technical specifications, the methods for delivery of the learning content, as well as how easily the users work with the system.

In contrast to the e-Learning systems, where the learners use personal computers with approximately equal hardware and software resources to view the educational material, the mobile learning systems may present the learning content on different mobile devices with different functional characteristics. At the same time different solutions for development of m-learning systems can be used which makes the choice of appropriate criteria for their comparison more complicated.

2. Proposed criteria for comparison of mobile learning systems

Today a variety of mobile solutions exists, which are used in different spheres of daily life – in the business, in the health care, in the education, etc. Some of these solutions are standalone applications which are executed on the user's mobile device and are not connected with a mobile management system. Such applications are not an object of this paper. Systems which manage the mobile learning and present the learning content on handheld mobile devices - cell phones, smart phones and/or PDAs are presented here.

During the process of defining the criteria for comparison of mobile learning systems the characteristics which vastly distinguish the m-Learning from e-Learning have to be taken into consideration. The learning content in m-Learning is visualized on mobile devices. Some of these devices have limited functionality (cell phones). On the second place m-Learning can be on-line or/and off-line [4]. If the learning is off-line the applications have to be loaded in the mobile device's memory which often has limited capacity. It is also important to determinate what kind of information the particular system supports – educational (learning content, exam tests, games, etc.) and/or administrative (news, SMS, etc.). During the comparison of the systems it must be taken into account if the system is independent of existing e-Learning platforms or it is based on such platforms. As there are no developed standards for m-Learning, yet, a suitable comparison criterion would be the e-Learning standards (SCORM, AICC, etc.) supported by the m-Learning systems. Important information especially for the future development of such systems is the programming language used for the development of existing systems. It must be mentioned that the m-Learning systems have to adapt the learning content for mobile devices with different visualization abilities, in contrast to the e-Learning systems.

The comparison analysis of the mobile learning systems is made using the following suggested by the author criteria:

- Type of supported mobile devices;
- Type of supported m-learning – on-line and/or off-line;
- Type of information which the system supports – educational (learning content, exam tests, etc.) and/or administrative (news, SMS, etc.);
- Supported LMS;
- Supported e-Learning Standards;
- Programming language used during the system development;
- Content adaptation technology.

3. Results from the comparison

The existing mobile learning systems can be divided in two main groups in dependence on the development organization:

- **Systems developed in universities** (Table 1). The main part of these non-commercial systems is used for scientific investigations of exact aspects of this new educational method. Very often the development of such systems lies on the ground of research projects. This type of systems is used mainly in the frames of particular educational organization or consortium of organizations and it is no widespread.
- **Commercial systems** (Table 2). These systems are developed by software companies and have wider spread than the non-commercial systems.

Twelve different mobile learning systems are examined in this paper. Six of them are developed in universities within the framework of research projects. The other six are commercial. The comparison of these 12 m-learning systems was done in 7 sections depending on the criteria. The results of the comparison of the systems are shown in Table 1 and Table 2.

Table 1

Mobile Learning System	Type of mobile device	Type of m-learning		Type of information	Supported LMS	Supported e-Learning Standards	Program language	Content adaptation technology
		On-line	Off-line					
Mobile ELDIT [11]	PDAs	web	partial (proxy)	Learning content	ELDIT	No	N/a	XML+XSLT Cocoon
WELCOME [8]	PDAs, Cell phones	web	No	Learning content, SMS	VUR	No	N/a	XML+XSLT
Pocket University [1]	PDAs	N/a	off-line	Exam tests	No	No	N/a	N/a
University Mobile Portal [20]	PDAs, Cell phones	web	No	News, SMS	No	No	Java	XML+XSLT Cocoon
MVClass [6]	PDAs, Cell phones	web	No	Learning content	No	No	N/a	XML+XSLT Cocoon
MobiLP [3]	PDAs	web	No	Learning content, chat	No	No	Java	XML+XSLT

The analysis of the results from Table 1 shows:

- almost all (5 of 6) non-commercial mobile learning systems support PDAs. Half of them maintain cell phones;
- five of these six systems support on-line m-Learning and two - off-line m-Learning;
- the main part of the systems gives to the users an access to learning content. Some of the systems have abilities to send SMS, support chat or exam tests;
- four of the systems are independent of existing e-Learning systems. The other two are based on e-Learning systems;
- at the present moment the non-commercial systems do not support e-Learning standards;
- because of the lack of information it is impossible to make a categorical conclusion about the preferred program language for development of mobile learning systems. It must be mentioned that two of the systems are developed with Java;
- the technology for learning content adaptation is XML based.

Table 2

Mobile Learning System	Type of mobile device	Type of m-learning		Type of information	Supported LMS	Supported e-Learning Standard	Program language	Content adaptation technology
		On-line	Off-line					
ObjectJ Mobile Learning [19]	PDA's	web	proxy	Learning content	Each SCORM compatible LMS	SCORM, AICC	Java	N/a
Meridian Player [18]	PDA's	No	off-line	Learning content, Exam tests	Meridian KSI Knowledge Centre	SCORM	N/a	N/a
GoBinder 2006 (Blackboard Backpack) [12]	Ultra Mobile PCs, TabletPCs, Laptops	No	off-line	Learning content & Course information	Blackboard	No	C++, C#	XML
Mobile Customer Education System [16]	PDA's, Cell phones	web	No	Administrative information Exam tests	No	SCORM	N/a	XML
iQpakk Mobile [17]	PDA, Smart phones with Java2ME	No	off-line	Learning content, Administrative information Exam tests	No	SCORM	C++	XML
Exact Mobile [15]	PDA's, Smart phones	web	No	Learning content, Exam tests, Chat	Learn Exact	SCORM	N/a	XML

The commercial mobile learning systems have the following abilities (Table 2):

- these systems support mainly PDA mobile devices. One of the systems (GoBinder 2006) supports Windows based Laptops, TabletPCs and Ultra Mobile PCs;
- the main part of them support off-line learning;
- the commercial systems maintain learning content and exam tests. Some of them also support an access to administrative information;
- four of the systems are based on existing e-Learning systems. Because these e-Learning systems support e-Learning standards (SCORM, AICC, etc.) this supposes that the corresponding m-Learning systems also support standards;
- the used programming languages for development of commercial m-Learning systems are C++ (in two systems) and Java (in one system);
- the adaptation technology is XML based.

CONCLUSIONS AND FUTURE WORK

The popularity and evolution of the mobile computing devices and fast mobile networks increase the range and complexity of mobile learning applications and services provided to the users of these portable devices.

The chosen criteria give an opportunity to compare different mobile learning systems. When the results from Table 1 and Table 2 are compared the following general conclusions can be made:

- at the present moment the mobile learning systems support mainly PDA's and to a certain extent - cell phones;
- the systems which are developed by scientific institutions support mainly on-line m-learning. At the same time commercial systems support off-line learning;

- both types of mobile learning systems used XML based learning content adaptation;
- in contrast to the commercial systems the systems from the first group do not support e-Learning standards yet;
- main part of the commercial systems are based on existing e-Learning systems. Among the non-commercial systems only two are based on the e-Learning systems;
- the commercial systems support wider range of information and services than the non-commercial systems which support mainly learning content.

The results from this comparison analysis are used by the author during the development process of a mobile learning system at the University of Rouse.

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