

EUNIS 2013: Mobile e-learning systems

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1. ABSTRACT

Education is a key element in the life of every person. In the recent years we have seen strong growth and development of information technologies, and as a consequence - informatization process in all areas of society. Particular attention is now being paid to mobile technologies, based on the analysis of the market it has been revealed that tablets and smartphones are one of the most promising areas of development in the near future. The paper presents an approach to design of the e-learning systems in terms of diversity of implementation on the side of the client/end user (mobile application, web application and a classic application for PC). To improve the performance of teachers and students the implementation of special units is suggested, such as the module of the analytical statistics for teachers, the module of additional advanced checking of home work and feedback module.

2. INTRODUCTION

We cannot imagine the modern world without information technologies (IT). The Internet, computers, smartphones, and tablets became essential part of every person's life; we are using them all day around. Among all other areas, the influence of IT is highly important in the educational process.

Nowadays there are a lot of various approaches that are deployed in the area but the progress is so fast that we have new solutions constantly appearing every day. The informatization influences the way the learning process is organized at the universities. This tendency can be observed in Russia in the recent period of time. On the one hand, it is the development of electronic libraries and catalogs; on the other hand, the amount of media materials used in the teaching process in a lot of quite different professional areas of study has highly increased. Besides, there is a growing demand for IT specialists, and new majors keep emerging in the IT industry. Now we also have such facility as on-line universities, which allow receiving education remotely. This possibility is very important not only for people with disabilities but also for those who live in distant areas or those who want to enroll into courses offered by universities in other cities or countries. The main feature of this method is big amount of independent work and the ability to learn the subject autonomously based on the given material and the special control system. Thus the e-learning systems have become one of the important tools in the education process.

How effective is this approach in education? Let us look at the couple of examples [5]. The poll results of professors of USA schools and colleges say that 57% of the audience consider that education at on-line universities has at least the same efficiency (or even more) as at traditional ones. 33.3% say that in the nearest future e-learning results will be better than those achieved at traditional universities. One of the interesting examples is the savings the famous IBM company achieved when the new on-line course for the new managers allowed saving more than 24 million US dollars. They reduced the price of one study day from \$400 to \$135. At the same time the amount of information given was 5 times greater. Unfortunately, in Russia we do not see such beautiful results now, but a lot of big companies (like natural gas giant "Gasprom", the railroads monopolist "RZHD" and other) have already started using modern technologies in the process of professional training of

their employees. In the US more than 50% of companies somehow use the e-learning approach in their work.

In the recent years more and more top colleges in the world open on-line universities, which allow students all over the world to enroll into various courses without entering the university itself. The goal of our research is to investigate the efficiency of mobile e-learning systems. This paper is dedicated to the design of the system, which provides various ways of working with this educational tool. In this paper we list some of the popular e-learning systems, which can be found at the market, we concentrate on the importance of the mobile applications nowadays. Afterwards we propose the approach in the e-learning process where the main goal is to combine the regular desktop application and the mobile application for popular gadgets.

3. E-LEARNING SYSTEMS

So what do we mean when talking about an e-learning system? Let us give some definitions.

E-learning system is interactive software, which is used for solving some educational problems; it contains information on particular subject and is oriented primarily on the person, who is getting knowledge from this system (student, pupil, working person, etc.) [3].

The main goals of e-learning are the following:

1. Give the basic knowledge on the subject, basic definitions, concepts and approaches;
2. Basic training for different levels of knowledge;
3. Development of skills to solve common practical problems in the given subject area;
4. Development of analytical skills and problem solving in non-trivial cases;
5. Development of abilities for certain activities;
6. Conducting educational research experiments with models of the objects, processes and practice area that are studied;
7. Restoration of knowledge, skills and abilities (for unusual/emergency situations, tasks, and technical operations);
8. Monitoring and evaluation of the levels of knowledge and skills [3].

Since the set of tasks is quite extensive we divide the variety of learning systems by type. This allows focusing more on individual problems when implementing a learning system. We list some of the basics types of educational systems. Currently there is no uniform classification of e-learning systems, but in many studies based on methodological purposes, the implementation of which justifies the introduction of e-learning systems, the following types are presented [10]:

1. Simulators. The main goal of this type of software is to develop the skills of practical solutions in the domain. It is assumed that the basic level of theoretical knowledge has been reached, so the main focus is on practical tasks. From a developer's perspective, for these programs it is important to take into account interface not only for the student but also for the teacher, so that the educational process can be controlled and can be easily modified.

2. Supervising programs. Obviously, for this type of programs the most important thing is to monitor and rate the levels of knowledge and skills. As it has been widely recognized, the issue of controlling knowledge is one of the key problems in the educational process. Monitoring programs are presented as a great assisting tool for the teacher. They provide automation of the control process and reduce the factor of subjective evaluation of pupils' knowledge. In terms of implementation of such systems the most common mechanism is the combined tests, where not only the multiple choice questions are presented, but also open questions.

3. Mentoring programs. These are applications that focus primarily on the initial introduction to the subject area, the development of its basic definitions and concepts. The main principle is interactive mode in communication with the learner, which allows the program logic module based on student response move to a new topic, repeat a past one or just start training again. In terms of development, special attention should be paid to the programming of the logical core of the software.

4. Demo programs. In most cases these programs are used as supplementary material for the professor. The main goal is to demonstrate various visual aids, interactive programs. It is scientifically proved that a person perceives most of the information by means of visual perception,

so increasing the number of graphics and video in the learning process can only make the subject more interesting for the class.

5. Informational and help program. First of all we mean electronic libraries, catalogs, encyclopedias, magazines, etc. The presence of these programs not only greatly facilitates the learning process for pupils and students, but also for teachers, professors and researchers. In terms of implementation, the search algorithms should be highly productive to achieve the best results in the shortest time. In the recent years, "smart search" became an interesting topic of research. The result of these algorithms is based not only on a simple matching of key phrases, but also takes into account the sense of the phrase.

6. Simulation and modeling software. This type of training programs is essential for teaching and research experiments with the models of objects, processes and practice area that are studied. When it is difficult to create necessary conditions of the experiment in the classroom, such programs will show the features of a given process. This type of software, in terms of development, must be designed to provide maximum flexibility for the teacher to implement the experiments in the framework of a subject.

7. Programs for problem-based learning. The software of this type can be used for basic training at different levels of depth and detail. The key here is the possibility of indirect management of students. Based on various tasks and examples, students can learn the study material solving tasks and problems, learning on their own errors.

There are also a huge number of different classifications of learning systems, proposed by major universities and companies; however, it is always hard to find the perfect hierarchy. As part of the above typology we can see that the main step in the design of the training system is to determine the range of practical goals and objectives that will be addressed with the help of this software.

However, let us look at the range of systems available on the market at the moment. Of course, the information on the Internet cannot give a full picture of the possibilities, and especially the internal design and features of the system. In most cases, we see only the user interface that manufacturers try to make as simple and user friendly as possible. Here are several examples of both commercial and free automated learning systems [15].

1. Commercial systems.

There are many commercial e-learning systems offered on the market, here are some examples of branded manufacturers [2].

1. CourseLab, product of the company Websoft.
2. Adobe Captivate, offered by Adobe.
3. Camtasia Studio, developed by TechSmith.
4. REDCLASS Course ("REDTSENTR").
5. SAP Tutor (SAP).

All of these products have some advantages and disadvantages, mostly the problems in usage are connected with the specific needs that were the core requirements of the product at the time of design. For example, some systems can be more useful in the simulation process, while others are better for video-lessons recording. The general advantage of such products is constant updates and support, at the same time it is also the main disadvantage because the cost is usually high.

2. Non-commercial systems.

A detailed review of non-commercial learning systems can be found in the article by V.A. Bogomolov "Overview of non-commercial learning management systems" [4]. Here we list some links to the products available:

1. MOODLE - one of the most popular non-commercial training systems [16].
2. ATutor - e-learning system developed at the University of Toronto, Canada.
3. System Sakai CLE.

As we see, there are already quite a number of solutions, and each one is tuned in accordance with certain needs of a specific manufacturer. This makes it possible to consider all the pros and cons of the already created programs when planning your own development of such a project. Thus the aspects that are important for the organization you represent will be taken into account. First of all, let's sum up everything on e-learning systems, to explicitly identify the positive and negative sides.

This will help in the further design process to define specifically the sides, which should be we will know what you should optimized.

Next, we try to identify the main positive and negative aspects of the question of automated systems of education.

1. Advantages of e-learning systems.

One of the main difficulties in the organization of the educational process is determining the time and place of learning. This problem is automatically canceled in the case of usage of e-learning systems, as the student can work with his own PC in any convenient time. Thus *the geographic location* is not a limitation any more (students can take on-line courses of foreign universities) and also *time* is flexible (in the case of on-line courses even the time difference is not a problem). For example, in the case of professional training courses, they can be easily combined with the regular work process.

The use of e-learning systems makes education more *person oriented*. Tutorials are formed so that they give the student the opportunity to return to the modules already studied, if there were any difficulties in understanding of the material. They can listen several times to the same section of lecture and learn it completely, which is quite impossible in full-time education. Quite often teachers are guided by the majority of the group, and, thus, the less successful students in the class lose control of the material. For these students, the teacher can make an individual plan in the e-learning system as well, and for outstanding students he can include more complex tasks. In the e-learning system the psychological problem is eliminated. The control system built into the program evaluates the overall level of student achievement in this subject only on the basis of the reply. Thus the personal relations between the teacher and the student are excluded.

Since the same training system can provide information on various courses a *universal representation of information* is achieved. This allows the student to navigate faster and easier through the system.

The important advantage is the possibility of an *interactive* presentation of information. Using different multimedia features (video, audio, animation, computer graphics, etc.) can make the material very clear, which ensures better understanding of the lesson. Thus, the effectiveness of the course significantly improves.

Automation of the learning process can make the teaching process significantly easier, giving the professors more time for their research activities and individual work with students, continuous updating of the course, etc. Automated process control also reduces the possibility of human error in deriving the final results.

From the economic point of view, the usage of e-learning systems significantly reduces the cost of rent, tuition fees, travel costs, rent expenses in another city, etc. On average, on-line education is 50% cheaper than regular studying at the university. This is important not only for education, but also for commercial organizations that use e-learning systems for staff professional trainings.

2. Disadvantages of e-learning systems.

Despite all the positive aspects of e-learning systems, there are also significant drawbacks, which some consider critical in the decision concerning introducing or restricting the use of automated learning systems.

On the one hand, the educational process with e-learning causes the lack of personal contact with the teacher, the lack of direct dialogue. In most cases this communication is replaced by e-mail exchange. One of the methods to solve this problem is a video-conference. The next question that arises is whether the teachers are ready to the transition to new technology. And are the students ready? Moreover, that autonomous learning using e-learning systems requires a high level of self-organization and self-discipline from the student. Also, all participants in the process must have good computer skills, at least the level of the confident user. Unfortunately, this factor still requires further development in Russia.

On the other hand, there are a number of technological problems. In terms of logistics, the user needs at least a personal computer with Internet access. Also the possibility of using e-learning systems in the educational process depends a lot on the profession. For example, in medicine and biology it is necessary to conduct a lot of workshops, which cannot be replaced by any virtual

reality. Another serious problem is the control of the student while performing the tests. It is necessary to ensure that the student is performing the tests himself, not with the help of a friend or neighbor, answering the questions of that test. And no additional information resources are used. These problems can be solved, but they require serious technical preparation from the developers. Thus, the creation of a high-quality e-learning system requires highly skilled professionals (designers, developers, documentation team, etc.).

However, observing the variety e-learning systems presented now in the market, we conclude that all these problems can be solved. The main challenge is to find the optimal balance between the positive and negative qualities of training systems and create one that is most appropriate to your goals.

4. THE GROWING ROLE OF GADGETS

Most e-learning systems are PC or Web applications. What about the rapidly developing market of tablets, smartphones and mobile applications? Let us discuss these issues in detail. First of all, let us take a look at the latest statistics [3]. General trends are the following:

1. Consumer interest in tablets and smartphones is actively growing, whereas interest in laptops is falling.
2. According to analysts, the average percentage of iOS and Android devices in the U.S. is 80%, this ratio is forecasted to stay the same in the next period.
3. Windows is starting to gain some power and has reached the level of 4% in the US.
4. In Russia, the audience of mobile Internet users increases 2 times faster than the audience of regular Internet users. In January of 2012 more than 22% of all residents of Russian cities with population over 100,000 people were using the Internet from mobile devices.
5. The most popular application categories are games, search, mail, news, social networking, music and video. For the average user it is much more convenient and faster to run them from the smartphone or tablet than turn on the laptop or desktop.

Statistical studies claim that since 2007 more than 500 million devices on Android and iOS has been sold. According to the information given by the company Flurry at the end of 2012, the total number of Android and iOS devices in the coming five years will exceed \$ 1 billion. At the same time looking at the sales figures of personal computers, IDC says that more than 800 million PCs were sold in the period from 1981 to 2000. It is easy to calculate that the distribution of PCs was 4 times slower [8]. According to Russian popular search engine Yandex, in 2012 users of the service YandexMarket in Russia were interested primarily in tablets [21]. By the fourth quarter of 2011, almost 27 million tablet devices were sold worldwide. The main tendency is that the interest in laptops has gradually reduced, its market share was taken by tablets. Demand for tablets has increased, and sales of personal computers are at about the same level.

According to the marketing company IDC in the period from 2012 to 2016 the market for mobile operating system will look as follows [5]:

Table 1. Forecast for the mobile OS share in the period from 2012 to 2016 according to IDC.

Mobile OS	2012	2016	Growth
Google Android	61.0%	52.9%	9.5%
Microsoft Windows Phone7/Mobile	5.2%	19.2%	46.2%
Apple iOS	20.5%	19.0%	10.9%
RIM BlackBerry OS	6.0%	5.9%	12.1%
Others	7.2%	3.0%	-5.4%
Total	100.0%	100.0%	12.7%

Recently, the rapid development of Android systems is observed. It should be noted that not only smartphones, but also tablets are produced based on Android. Tablet device charms the audience with its ease of use, flexibility and mobility. What devices have been replaced by the tablet? According to statistics from Google, for 59% of the respondents tablets replace paper books, 52% listen to the radio through the applications for tablet PCs, 43% use them instead of PCs and laptops, and 41% prefer tablets to smartphones [10]. 77% of the audience claim that after purchasing a tablet they only sometimes use the regular PC. For 28% of the respondents the tablet has become the main computer.

A distinctive feature of the PC, tablet or smartphone is the presence of applications. According to Furry, 40 billion applications are already downloaded from the App Store and Play Market [8]. Applications allow users to search for more specific information, such as searching for particular object or category of objects (stores, restaurants, movies, newspapers, magazines, etc.). In this case, according to the search engine Yandex, the number of users browsing the Web sites from different devices has increased several times, i.e., iPad - by 5.8 times, smartphones - 2.5 times, desktop PC - 1.4 times.

For the first time Flurry published in their report the information that the average smartphone user spent more time on using mobile apps than web browsers in 2011. This trend has not changed. In the graph (Figure 1), we see a steady increase of the time that the users spend on applications. In Figure 2, we can see what types of mobile applications are the most popular within the owners of [10]. On the basis of statistical data we conclude that the rapidly growing market for mobile applications is extremely popular. Thus, using it as one of the inputs for the development of e-learning systems can bring only positive effect in the overall picture.

Nowadays, there are many educational games and applications designed primarily for users of pre-school and elementary school age. Subjects can be different, but the target audience is still mostly under 18. Our aim is to consider the relevance of creating a mobile application to e-learning system that can be used by learners of all ages, such as schoolchildren, students and employees of large organizations that are using different professional training courses.

E-learning systems written for the smartphone or tablet will not completely replace standard versions for the PC or the Web console, primarily due to technical constraints. Technical capacity of the modern personal computer and tablet is not comparable, but whether there really is a need for a mobile application with all the functionality of the system?

The reasonable answer to this question is no. The main reason lies in the purpose of using the tablet or smartphone, and the correctness of this statement is confirmed by the above presented statistics. Tablets and smartphones are not intended to fully replace a PC. These devices have relatively small screens, it is not comfortable to use them working with lots of text, it is impossible to draw precise graphs, programming is also quite different. All that sets limitations for some specific actions that may be needed, for example, when doing homework. However, the mobile application is suitable for tracking test results, checking messages from the teacher, participating in the discussion on the forum on a topic related to the subject, watching educational videos and materials on the subject. Thus, such application allows performing a variety of actions required in the training process. Here we conclude that the main advantage of tablets and smartphones, which is mobility, is an essential tool for education. We describe in detail our proposal on how to combine classic e-learning system and the latest technological advances in the field of mobile applications in the next chapter.

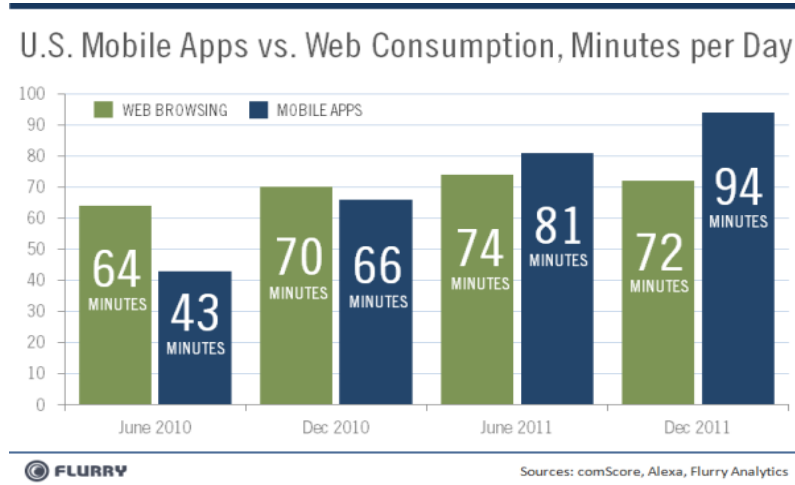


Figure 1. Comparative analysis of the use of applications and browsers, in minutes. USA.

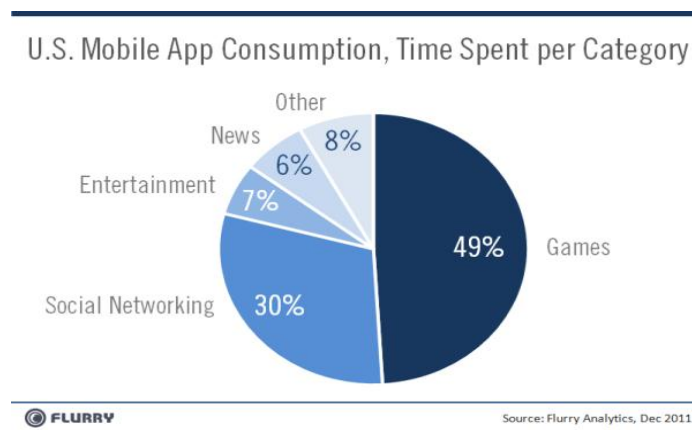


Figure 2. The most popular categories of mobile applications. USA.

5. SYSTEM DESIGN

So, on the basis of the advantages and disadvantages of automated training systems, let us formulate the main requirements for a modern e-learning system.

1. Universal approach.

The same program interface should be equally easy to use for various subjects (art, science, informational science subjects). However, it should be remembered that for some sciences the usage of e-learning systems may be less effective because of the need to have specific practice. For example, in medicine - communication with patients, in biology - experiments with animals, bacteria, etc.

2. Usability.

It is especially important to have a user-friendly interface. Because even if there are a lot of features in the product but the usability is bad, people may never know about these components of the product. Here also documentation, help options and multiple language support should be mentioned. Users of the training system can generally be divided into three groups: teachers, students and administrators. This should be also taken into account in the process of design, as the interface should be highly adapted for each type of user.

3. Modularity.

In the application we need to have an ability to link different modules in the program for courses of different levels of complexity, with some having a common part. Modularity also implies the ability to separate the parts of the software, depending on the type of user (administrator, teacher, and student).

4. Technical aspect.

An application should not have high system requirements; major operating systems (Windows, Linux, Mac OS) should be maintained. For mobile applications we include Android, iOS.

The main idea of our solution is to implement a training system with multiple views, thus greatly improve the convenience of its use (Figure 3). With a mobile application for training students can check whether the results of their examinations are known, or whether homework for the next week is already posted, take a control test at any time, from anywhere in the world where there is Internet access, verify the schedule, repeat study material, for example when using public transport. Teachers can track the number of homework assignments sent on time, tests and find out the results on the tests, calculated by automated system. That is a specific list of activities that can be carried out much more easily than in a standard way, with the help of personal computer, including the time that it takes to connect to the Internet and open the program.

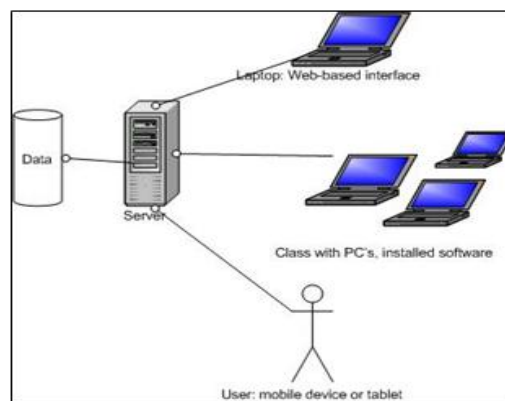


Figure 3. The organization of the system.

Why should we go with a mobile app, and not the usual web-based console that is loaded in the browser? The above presented statistical analysis shows that more people use applications, rather than a web browser. As well, application development is specific to the operating system, which allows making them faster and more convenient. Of course, the implementation of the Web-based console also has some advantages. For example, you can use it to connect to the system using any computer without installing the learning system itself on it. Still, due to the increasing growth in demand for smartphones and tablets, we propose a mobile application approach.

Thus, the solution will consist of two fundamentally different components - an e-learning system for personal computer and application designed for smartphones and tablets, with limited functionality. Further we propose major differences in functionality in both parts of the project, discuss feasibility of such a division of action and features, and common tasks for components. As mentioned earlier, speaking of users, we are referring to three categories, namely, teachers, students and administrators.

1. PC application.

Based on the variety of samples of e-learning systems we select the modules that form the basis of the training system. For each type of user a set of modules is defined rather uniquely depending on the nature of their actions (Figure 4).

A Teacher - a module for creating e-learning course (create, edit, delete), which includes lectures, practical assignments (the ability to upload and download documents, videos, audio files), a module for creating tests, the ability to automate test scoring, statistics module. With this set of modules,

the teacher can easily perform basic operations - to teach the course, perform tests and monitor the progress of pupils, to give advice.

A Student - a course catalog is a module that allows you to read the description of the course, the schedule, and the requirements on the subject and register for it; module for studying (lectures, workshops), a module for sending homework, a module to perform control tests; a module to view the results of their performance on the courses.

There are modules equally important for both the teacher and student, like module containing personal information (phone number, email address, office hours of the teacher) and the discussions module (similar to forum), where the teacher and the course, all students can discuss the problems, challenges, problem tasks, their wishes and suggestions. Interesting addition for this module may be an ability to post a new topic in social networks (Vkontakte, Facebook, Twitter), which will help to quickly draw the attention of other students taking the course on this issue. In the future, for teachers and students it would be possible to open documents, run executable files directly from the training system (this involves the use of third-party software).

The administrator has the ability to control all of the above modules, also he completes the registration process of the users (teachers and students) in the system, provides technical support for the system. In this case, the control should be designed in such a way that even non-technical people can easily understand the system.

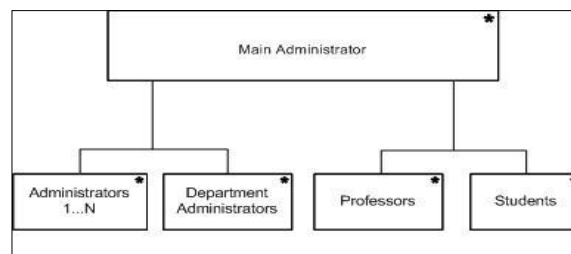


Figure 4. The hierarchy of the roles in the system.

2. Mobile application.

This component of the system is primarily for informational purposes. From the users point of view, time-consuming features (for example, creating a new e-course for a teacher) are uncomfortable to use from a tablet or smartphone. Thus, we optimize the list of modules available in a mobile application.

For teachers it is important first of all to assess the current status of students in a particular course. Thus, the statistics module should be available; it should cover a wide range of tasks: individual performance, the average performance, the number of homework assignments sent on time, students' activity in discussions and more. An important option for teachers is a possibility to make changes in the schedule in real-time or notify the entire group on a particular course that lecture or discussion is suddenly canceled or postponed to another time. This can be achieved through the internal messaging system in the e-learning system or by integration with email service.

For students both training schedule and their current academic results are important. In extreme cases, they can use the mobile application for taking the test urgently. Study materials should be also available as part of the application for them, to allow reviewing some information. Thus, a mobile application for students is a very important component. And because mostly young people use electronic systems and own most of the modern gadgets this feature is very useful for them.

Administrator role in the mobile application is minimal; in fact, he may provide only some assistance with certain actions if users have reported problems with permissions, etc. Since the bulk of the administrative action is necessary on the application for Personal Computer app.

We have identified the main principles of the e-learning system in terms of its two components - PC application and a separate application for smartphones and tablets. In the future, the third component of the system is a Web-based console that is generally closer in functionality to a full

application for the PC. But again, running from the tablet the console will be able to support only those mechanisms that are implemented for mobile application.

Currently, more and more developers of existing systems are starting to implement new modules, namely, provide support to work with mobile devices (tablets and smartphones). However, this process is very time-consuming for them because of the need to adjust radically different components under the currently running system. In this case, it is much more rational when starting new development to think of ways of integrating the system architecture in terms of the basic principles mentioned above. That is a single server and multiple views on the client-side.

In addition to these basic principles of the system, we offer the following interesting modules for teachers and students:

1. Analytical statistics for teachers.

It is highly important for teachers to know how well students learn the subject; they can make conclusions only on the basis of control and test activities. Thus, the statistical information is essential for summing up the results. But it is also necessary to take into account focus on individual learning, which is very valuable for those who have selected e-learning systems as a tool for their educational process. Because of this individual factor it is important to have the possibility to look at the statistics for each student as well as for the entire group of students for the course.

In addition, this module will be implemented by a set of logical rules that allow, based on various criteria, to give general advice on the courses: which modules need to be repeated, what homework assignments are more or less complex and more or less understood by students, etc. This analysis is also important for both each individual student and the whole group.

From the developer point of view, this module may use a certain analytical algorithm with adjustable parameters that can be tuned by the teacher, and a more complex implementation using some expert system or self-learning neural networks.

The primary objective of this module is to provide a complete picture of the process of training for teachers; however, a statistics module may also be interesting to the student.

2. Preliminary control system for submitting homework for students.

As one of the most important components in the e-learning system is control of the level of knowledge obtained, particular attention should be paid to this aspect. However, since the main advantage of e-learning systems is the ability to automate processes, the higher is the level of automation of the system, the easier and more practical it is. As an additional self-control system, we offer a module to implement preliminary control when submitting the homework.

The main idea of this approach is that the system performs some additional checks when uploading homework. The result is an informational message to the learner, demonstrating the validity or invalidity of the submitted task. Based on the response, the student can then re-upload his homework already with some modifications, if the original exercises have been carried out not quite right. To implement this approach, a set of tests to verify the job is needed. Such set can have quite different forms, from basic check for the correct answers of the math problems to various tests checking the correctness of the output of some programs delivered as assignments for programming courses.

This module will depend a lot on the particular subject and the approach of the teacher. For technical courses it is much easier to add such control than for the art courses. So the efficiency of the module depends on the teacher. The general approach in art classes with various essays can be, for example, the search for key words on a given topic, defined by the teacher, in the response of the student. For example, in programming courses the control condition to the minimum practical tasks may be simply an ability to compile the program, and more serious approach will have some test units, checking the correctness of the input parameters, output results and test the operation of the program at different operating systems, etc.

For students such module also provides invaluable help. It is obvious that with proper organization of the time, they can upload the homework in advance to the system and get a preliminary result. So they know whether their work fits the minimum requirements for this task.

Such verification system does not involve full check of the assignment on-a-fly, but allows students to significantly improve their results. For teachers such module also provides an effective time

management tool: the time taken to prepare the preliminary tests for jobs will reduce the time needed to check homework, and improve the quality of the provided solutions.

3. Feedback.

One of the most common methods in many areas is a system of feedback and suggestions. From our point of view, for the success of the learning process the presence of such a system is necessary. The use of such a module in e-learning systems is simple for users, thanks to the process automation; the results are calculated quickly and are immediately available for the teacher. This module performs several functions:

1. Evaluation of the teacher - how effective his method of teaching is, whether he explains the material well enough, whether answers the questions and emails quickly, etc.
2. Course evaluation - whether that course content suits expectations, do selected materials cover the subject, were the home assignments effective, how is the control system implemented, how popular is this course among students, etc.

A distinctive feature of this survey is that it can be made up of the same questions regardless of the course topics, and include some specific questions that will be important for a particular teacher and course. Thus, based on the same type of question generic system of evaluation of courses and instructors can be designed, organizing a whole rating system. Rating will help future students to select from a variety of courses, presented by different instructors, as well as organizations that use this training system for professional trainings, evaluate the effectiveness of professors and courses.

What is the educational system from the developer's point of view? This is a complex application primarily divided into front-end and back-end. In fact, it is based on a client-server architecture where the client side has different views. On the one hand, the client is a separate application for the PC, on the other hand, it is still a mobile application, which uses completely different design principles. However, this is all part of the same system, and they work with the same data that is stored on the server. In the future the third look of the client side is Web Console, which is also implemented by individual technologies. Thus, it is necessary to pay special attention to the development of communication protocol between the client and the server, the protocol remains the same for all versions of the client. The other important question is synchronization. For example, when using a file-sharing service Dropbox, files are downloaded from one device to the shared folder, and then displayed at all devices that run with the appropriate application. Each module in the system requires a separate development, a careful study of the mathematical model and only after that implementation.

Thus, the novelty of the solution lies not only in the choice of a new long-term approach to client-server architecture, but also in the introduction of new modules for the convenience of teachers and students. We consider these ideas will increase the popularity of the mobile e-learning systems and increase the impact of the technological progress in education. The usage of new technologies will allow making the study and teaching process more interesting and efficient. Therefore we are working on this hybrid approach that will use the latest technologies in the field of education. In this paper we provided the description of the design approach, some statistical information that confirms the growing role of mobile applications in everyday life, presented general definitions and discussed the importance of the educational systems. These are the fundamental bases of the research, which is dedicated to the applicability of the mobile technologies to e-learning process.

Our design approach is promising in terms of end-user response, as it is a priority to increase availability and convenience of e-learning systems for users. Based on statistical data, we can conclude that the audience of Internet users and advanced mobile devices is increasing. Education has always been a key element in the development of the society. Thus, the introduction of the latest technology innovations in the educational process can only promote the development of the state and society.

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