



MOBILE APPLICATIONS IN EDUCATION

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Abstract:

The problem we tried to solve is based on an assessment of the current state of mobile applications, services and platforms applicable to the education process. The current state of these services is viewed from the domain of their technical solution (availability, support from multiple platforms, ...) and the domain of legal norms application governing distance learning. The problem of using mobile applications is reflected in the adaptability of these services to the educational process, as well as in the equipping of students with mobile devices where the teaching process can be monitored. The research has shown great availability of such services. In contrast to the availability of e-services, their implementation is far less than expected, which is especially underlined in primary and secondary education institutions, as well as in universities that are not in the field of technical sciences. Furthermore, institutions that have an eLearning system do not have adequate rules and legal norms that precisely regulate the learning and grading processes.

Keywords:

e-learning, e-testing, mobile devices, web platforms.

INTRODUCTION

Modern information and communication technologies as well as their increasingly frequent application have become an integral part of everyday life and work of people. With the help of digital technologies, people communicate and connect with each other. Some examples of the most commonly used communication and social interaction services are email services and social networks [1]. Taking advantage of digitalization, the educational system around the world is increasingly relying on the use of new hardware and software solutions in the daily performance of teaching activities. Elementary and high school students, as well as college students, can now transfer their classrooms to computers and mobile devices. In this way, the availability of education is not conditioned by the proximity of educational institutions or the presence within the auditoriums. Course participants can attend classes even if they are in remote and inaccessible areas.

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The development of the use of computer and mobile applications intended for education differs depending on the institutions and the region. Mobile technologies stand out as one of the most important technologies. Viewed from the angle of productivity and practicality in the use, mobile technologies represent one of the revolutionary tools. Applied to the educational system, mobile technologies allow students to use smart devices and mobile phones during classes to acquire new skills and learn new things. Different types of smartphones and other digital devices can be used as very useful scholastic resource both in the process of distance learning and in classroom university studies [2]. In the digital market, both in the form of free applications and in the form of applications for whose use users need to paid, a wide range of applications intended for use in education can be found. Viewed from the perspective of mobile learning, mobile devices must meet different forms of commercial use, language support, and support for different types of learning processes. Nowadays, a clear parallel between real and digital life is visible. Transferred to the learning process, the parallel is advertised in making contacts and communication with colleagues, online work on domestic and international projects, exchange of teaching materials, taking exams, etc. [3]. Using online and mobile platforms today, students anywhere in the world, no matter how far they are away from the professor, can follow classes in almost all fields, such as mathematics, physics, programming, foreign languages, etc. The use of distance learning systems must be accompanied by adequate information and communication equipment of course participants. Also, the successful implementation of distance learning is conditioned by the equipment of the institution, as well as a set of legal norms that regulate the distance learning process and especially assessment process. In most countries, primary and secondary education is insufficiently organized and not prepared for the distance learning process using mobile applications. This type of education is closer to higher education institutions. The aim of this paper is to consider the readiness of educational institutions of the Republic of Serbia in terms of the application of distance learning through the use of mobile platforms. The implemented platforms for distance learning of educational institutions of the Republic of Serbia have been compared with similar platforms of educational institutions in the world. The assessment process as one of the indispensable parts of education is especially demanding when it comes to the implementation of distance tests. This type of assessment must first be provided for by the legal acts of the education system. For this reason, the

paper considers the legal regulations of higher education institutions that have implemented systems for distance learning.

Paper is organized as follows. The first section presents similar research related to the topic. Second section presents some of the most popular distance learning and mobile learning platforms and applications that are in use worldwide. Third section presents platforms and applications that are in use in the Republic of Serbia. The main conclusions are given in the fourth section. The last section represents used references.

1. RELATED WORK

In one of the research the authors investigated the effects of mobile devices on the learning process. Their research is based on design approach [4]. This approach was chosen in order to support two main objectives. First objective was to support designing tools created for usage in learning process. The second objective is chosen to support conducting of pedagogical interventions. By meeting the set two basic objectives, the authors achieved a connection between researchers, professors and students. In order to prove their theory, authors implemented different mobile applications that were used as test applications. The created applications were adapted to both individual users and working groups. One of applications that were used for individual users was named ReFlex. From the other side, for the collaborative use TeamUp application was used. Design for the both applications is optimized for the use on the mobile devices (tablets, smartphones, etc.). In the same time, design provides use on some other devices such as laptop computers and smart whiteboards. Created and described applications were intended for use in teaching that is performed within the classrooms of the faculty. Besides teaching using these applications, students could work on projects individually or in groups.

Research conducted at the Spanish National University of Distance Education encompassed the current activities that include the use of mobile phones and applications created for the specific needs of subjects. The results of this research are given in [2]. The main goal of the conducted research was to assess didactic use of the applications. In the same time, authors tracked the potential of applications in order to improve the subject learning process at the university. The main goal was to develop the generic competencies based on European Higher Education Area. Evaluation process was conducted based on the predetermined scale.



In the conducted study 388 students participated. Students who participated in the research attended a course called “Curriculum design and innovation” within the “University Degree in Pedagogy” program. At the beginning of the research, the authors set out two basic directions of research. The first is through a descriptive methodology. This meant that the researcher had to describe in detail the creation process of the used application. The main actors of the second perspective were students. In this phase students’ perception and improvement in learning process were assessed. It was especially important to assess the progress in students’ knowledge conditioned by the use of mobile devices and applications. The results of the assessment showed that the impact of mobile devices and applications on student learning is highly valued. One of the main conclusions is that universities need to continue to develop new didactic strategies that will be used in order to provide better learning process.

The research described in [5] presents the results of a project in which students from two countries participated. The aim of the authors was to discover the perception of the use of smartphones in the process of education both by students and teachers. The student’s task was to create YouTube tutorials in which they described possibilities of using mobile devices in the learning process. The learning process was based on the use of applications available for mobile platforms. Based on all available information, authors explored the use of smart mobile devices in the classroom.

In the research presented in [6] authors explore different parameters that have an impact on the learning process. Based on explored group of parameters, authors proposed specific strategies which include the use of mobile technologies and applications in the everyday students activities. The main ideas from which the defined strategies emerged were based on literature research, comparisons with similar researches, as well as specific individual needs. The first of two main questions defined at the beginning of the research were whether technology can assist in the learning process. The second question that authors analyzed is focused more on the teaching process that is performed in classrooms as well as on the pedagogical aspect that is manifested in direct communication between teachers and students. As a result of the research, the authors singled out eight potential technical solutions and applications. Based on these applications the authors identified and defined four possible strategies: problem based learning, situated learning, collaborative learning, and cooperative learning.

Each of the defined strategies practically represents one type of learning style. Defined applications as well as examples of their use in the educational process were created in correlation with information and communication technology. Details of the use of each of the applications are described in detail and discussed within the ISO9241 part11 standard.

The research conducted and described in [7] aimed at a different approach. The main goal of the author was to explore the opinion of teachers about how much mobile technologies and applications have an impact on the learning process, especially if they are used as a teaching tool within the teaching process that is performed in classrooms. The teachers’ attitude is especially important precisely due to the fact that the attitude of teachers regarding the use of a teaching aid has a great influence on the teaching process. The research included 12 primary schools in Spain. From 12 selected schools, 102 teachers were selected. The selected teachers had the task to fill in the questionnaire with various questions starting from personal information, through expressing personal views on the use of mobile applications in the learning process. Based on the results obtained by processing the questionnaire, two main factors of the impact of mobile technologies on the learning process that is performed in the classroom were identified. The first factor is facilitating access to information, while the second is increasing engagement to learning. In addition to the mentioned results, the research showed that selection of application that will be used in the learning process also largely depends on the opinion of the professor on how and to what extent a specific application can affect learning.

In the research presented in [8] authors described the results of research related to implementation possibilities of technological applications in medical education. More precisely the goal of research was related to implementation and application of Technology Acceptance Model (TAM). In the same time, the research was supposed to show that this model can be applied in order to measure the degree of acceptance of the use of mobile technologies and applications within medical education. The research methodology was based on a created questionnaire, which was filled out by students and employees from University of Salamanca. The results of the research explained that 46.7% of users decide to use mobile allocations based on acquired habits. The authors concluded that this data can help them in adapting the curriculum of the medical faculty in order to introduce the use of mobile applications in the educational



process [8]. Another conclusion of the author is that the research showed that there are many unknowns about the use of mobile applications in medical subjects, both from the point of view of students and from the point of view of professors.

2. MOBILE APPS IN WORLD EDUCATION

The rapid development of human society, everyday human activities as well as applied technologies has conditioned the need for continuous learning. Because of that, a person today could not imagine the time when it was enough to know one skill in order to work for their whole life. In order to get a better job and thus achieve a better quality of life, people must constantly improve their knowledge. The use of digital technologies to provide support for distance and mobile learning creates the opportunity for students and professors to acquire and improve their knowledge and skills. These technologies make learning independent of location and time. Learning applications base their work on modern mobile technologies. Also, different approaches such as psychology and gamification make the learning process easier and more tempting. Precisely because of the different possibilities of application many schools and universities already use distance learning mobile applications to make learning more interesting. These applications can be used on various mobile devices like mobile phones, tablets, lap tops, etc. In some cases, such devices can be used as learning tool within the classroom during the classes, or for distance learning.

In order to reduce the pressure that the teaching process leaves both on students and professors and to make learning more appealing, a lots of different approaches and applications are developed. Beside the fact that learning process can be organized online through the use of online portals, students can use different mobile applications for mutual communication, as well as for communication with professors, taking notes, sharing files, etc. Whether it is applications used during in-class teaching or applications used for distance learning, applications facilitate the learning process. Practically, the benefit that mobile applications bring both to students and educational institutions is constantly increasing [9].

The popularity of educational applications is largely reflected in their mobility. Application mobility is important quite because people do not have much free time for additional training and learning. Because of that, in order to get additional knowledge, they turn to

using mobile applications instead of attending classes and sitting in front of a book [10]. With the use of mobile devices and educational applications, students can learn anytime and anywhere. Some of the main benefits for students that use mobile applications are numbered in continuation:

- Learning process is not dependent of place and time
- High levels of commitment
- Constant assessment process
- Learning strategies proven in practice
- Modern learning methodology
- Great learning experience gained thanks to the Internet and modern ICT technologies
- Monitoring student progress
- Social characteristics
- Everyday motivation

The use of information and communication technologies in educational institutions has led to the introduction of new frameworks, models of work, as well as ways of working, all in accordance with the modern needs of students and professors around the world. Applications whose purpose is to be used in the educational process, in addition to basic functionalities, also have the task of making the learning process more interactive, more committed, and more successful.

A large number of feasibility studies, as well as research have shown that the use of smart devices and mobile phones in the learning process is far closer to today's students compared to the traditional use of books. The results of such research are confirmed by the fact that today's students have encountered mobile phones and use them since the beginning of their childhood, which justifies the slogan of "education in your hands. Different mobile applications that can be found and downloaded from application stores can be classified into the following categories:

- Online tutorials and online schools
- Application for paying tuition fees electronically
- Attendance records applications
- Worksheet and workbook management applications
- Applications for telling stories to children
- ERP software for universities
- Online quizzes and tests



Learning applications and different learning platforms created to run on mobile devices have provided a way to expand educational courses. The education process is currently available to all age groups of people, starting from children to retirees. Different groups of people access different online courses. In doing so, they all have the same goal, and that is to learn new technologies like robotics, artificial intelligence, computer vision, etc. In most of the cases these courses are free of charge, and are organized by some of the best universities in the world. With the use of mobile learning applications as well as distance learning platforms, the availability of top courses has increased not only in the education system but also within the industry. For example, many companies allow their employees to follow the courses of different universities in order to improve their knowledge and thus acquire the necessary knowledge in the field [11]. The basis of the use of mobile technologies in education is reflected in the collaboration of students and professors with each other, both within the classroom and outside it. It is possible to find a large number of applications on the market that store student activities and monitor the performance of their learning. Such applications can be accessed from multiple devices and from anywhere. Some of the applications that can be used for this purpose are TeacherKit and Attendance application. Some of the tracked performances are attendance, grade records, performance assessment, etc. At the same time, the applications have functionalities such as informing parents about their children's progress, achieved test results, possible problems as well as grades [11].

One of the applications that allow students to watch video lessons from their home is Flipped Classroom. This application is widely accepted by students and professors around the world. Practically, students from home follow the lectures in the form of video lessons that the professors were previously recorded. In this way the time spent in classroom can be used for discussion, questions and possible additional research [11]. This way of working enables students to study in a pleasant environment of their home, which causes the improvement of the achieved results. Viewed from the angle of students who have problems with learning disabilities, the use of such applications can help them overcome disabilities and gain better knowledge. Finding the right educational application is a very easy task, given that in 2020 there are over 500,000 applications. The large number of available applications indicates their popularity. On the other hand, from the users' point of view, it is necessary to find a suitable application from a wide range of ones.

In the field of education technology, the main goal of most of the applications created to work on mobile devices is to improve educational experience of both the student and the professors. If we search for services like the App Store and Google Play Store, we can see that tens of thousands of applications intended for education can be found on them. Available applications cover a wide variety of areas from learning different skills, languages, math, programming, etc. [12]. Some of the most innovative and used applications for students, teachers and parents are described in continuation.

If the quality of the application is assessed based on the number of users who downloaded and used the application, the reminder application in the United States holds the leading position with the highest number of downloads during 2018. The Remind application is practically an online communication platform that enables students to successfully complete the set tasks through the exchange of messages during and after the class. By using this application, students can send individual or group messages in more than 85 languages, can exchange files, images, documents, etc. The popularity of this application is evidenced by the fact that it is used in more than 95% of public schools in the United States, which represents a total of 27 million users, both students and teachers and parents. The second most downloaded application in the United States from the group of educational applications is known as Photomath. This app has approximately 10 million downloads. The main purpose of this application is to help students master the material in mathematics. Practically this application represents some kind of camera calculator. The main purpose of Photomath application is to identify mathematical problems based on camera created photo. When the problem is identified, the application shows all steps in solving the problem on the mobile device screen. Scientific calculator is an integral part of the application. By using this application, students master the material of mathematics much easier, and simply come to the solution of mathematical problems practically through the game. Photomath application is available in over 30 languages.

When we talk about learning a language using an application, one application stands out. It is an application called Duolingo. Duolingo is an application that enables learning of over 30 most popular languages. Its download is completely free. The users of this application are offered a quality work environment, as well as the ability to monitor learning progress.



Another application that offers distance learning capabilities using video streaming is Zoom. This is practically an application that can be used for any type of video conferencing. The number of simultaneous users is not limited, so that a large number of students can follow the lectures of professors at a given time. In addition to video streaming, teachers can use this application to share files, lesson plans, and additional materials and exchange text messages with individual users or with a group of users.

Edmodo represents learning applications that is which is intended to students, professors, and different educational organizations. Through the use of Edmodo application user can exchange messages, course materials, create and solve quizzes and tests. One of the benefits of the Edmodo application is the creation and use of accounts for parents. Such accounts allow parents to monitor their children's activities, homework assignments, grades, as well as exchanged messages with teachers.

A large number of educational institutions around the world provide their students with the opportunity to follow classes using online platforms. The created online platforms are adapted for use on different types of devices, as well as on different operating systems. The courses available on the raised platforms contain both learning materials and interactive quizzes and tests to test knowledge. Depending on the level of the educational institution, the platforms may be owned by them or the courses are offered within a portal that combines different courses from different educational institutions. One of such portals is Coursera. Coursera portal as a portal whose main purpose is to enable distance learning has cooperation with more than 200 leading universities and companies. Content from almost all scientific fields can be found on this portal. The courses available on this portal are created by eminent experts and professors for the given field. The materials available within these courses are also used by their creators in the daily teaching process within the classrooms of the faculties where they work. The quality of the material is evidenced by the fact that each course is signed both by the professor and by the university where it is initially conducted. Coursera offers about 3900 courses and specializations intended for different levels of study. For a large number of courses, participants are given the opportunity to check their knowledge through a series of tests and quizzes after completing the course, and for the same they receive a certificate of successful completion of the course.

The symbiosis of universities and online learning platforms shows how much the availability of knowledge via mobile devices has developed around the world. There are practically no restrictions on the availability of knowledge in this way. Another example is Udacity. This university is one of a group of universities that have their own online learning platform. On their platform you can find a large number of courses that belong to different areas.

3. DISTANCE EDUCATION IN REPUBLIC OF SERBIA

Various courses available within the online platforms offer the opportunity to the Serbian citizens to improve their knowledge and skills. By searching the courses, it can be seen that there are a small number of available courses in the Serbian language. Available courses are offered for a certain fee, and last for a certain period of time. The fee includes access to the course materials as well as the final exam based on the outcome of which it is possible to obtain a certificate of completion of the course. Of course, the fact that foreign language courses are available on world-famous portals such as Coursera cannot be ignored. In this way, the citizens of the Republic of Serbia can follow the same courses as the participants abroad, and receive certificates of successful completion.

Distance learning within the school education system using online platforms and mobile applications in the Republic of Serbia is regulated through two basic legal documents. The first document is the Strategy for the Development of Education in the Republic of Serbia until 2020¹. This strategy deals with determining the purpose, goals, directions, instruments and mechanisms of development of the education system in the Republic of Serbia over a period of ten years, in other words, it deals with the attempt to shape the development of this system in the best known way. The strategy defines the development trends of both primary and secondary education and higher education. It is possible to analyze the visible effects of this strategy on the expiration of the mentioned period. The strategy defines basic norms of distance learning as well as its implementation both at the level of primary and secondary education and at the level of higher education.

1 Strategy for the Development of Education in the Republic of Serbia until 2020, Retrieved 15.05.2020. from: <http://www.mpn.gov.rs/wp-content/uploads/2015/08/STRATEGIJA-OBRAZOVANJA.pdf>



However, the number of educational institutions that conduct distance learning using mobile technologies is far less than the total number of institutions that conduct traditional forms of education. Observed from the angle of equipping institutions with information and communication hardware and software equipment, it can be noticed that still institutions, especially primary and secondary schools, are not equipped with sufficient quality for this type of teaching.

Another legal document on which the development of education is based is the Law on Higher Education². According to the Law on Higher Education, distance learning is allowed in Serbia. Article 43 defines that any higher education institution may conduct a distance learning program, in accordance with the work permit. This practically means that every higher education institution that has a license to conduct distance learning had to previously met all the conditions for quality teaching in this way. The conditions that need to be met are defined within the accreditation standards. Article 96 of the Law on Higher Education defines that closer conditions and ways of realizing a distance learning program are regulated by a general act of a higher education institution.

Serbian legislation does not recognize any other way of taking pre-examination and examination obligations, except for the physical presence of the student in the institution itself and in no other way. The vast majority of higher education institutions that educate students at a distance still do not allow online taking of colloquia and exams. With this, schools distanced themselves from possible cheating on exams, and students from the ridicule of the environment that "Google" passed all their exams.

The preparation of colloquium and final exams is held exclusively in the premises of the School and there is no difference in their organization for distance students and students of classical studies. The student of distance studies is then obliged to be physically present at the School and to take the exam in person.

The manner of conducting the exam is defined in Article 105 of the Law on Higher Education. Paragraph two of this article defines that the exam is taken at the seat of the higher education institution, i.e. in the facilities specified in the work permit. The provision of paragraph 2 of Article 105 also refers to conducting a distance learning program, with the proviso that for a foreign student, a higher education institution may enable exams via electronic communications, provided that the application of appropriate technical solutions ensures control of student identification and work.

² Law on Higher Education, "Official Gazette of RS no. 88/2017, 73/2018, 27/2018 - other. law, 67/2019 and 6/2020 - other. laws"

Paragraph 10 of Article 105 defines that the detailed conditions and manner of taking the exam via electronic communications referred to in paragraph 3 of this Article shall be regulated by the standard for accreditation of distance learning programs.

The secondary education system does not offer the possibility of distance learning, so there are no applications available with learning materials. Distance learning failed the exam during the Covid 19 pandemic. It was especially noticeable in the area south of the Sava and the Danube. Practically, teachers in primary and secondary schools are left without any preparation to just figure out how to organize classes. The most common form of teaching was via Viber groups, in which the influence of the school was almost non-existent. Practically, the teachers themselves found a way to work with students, which may not have been ideal, but it was almost the only viable solution. The observed problems were reflected in the unavailability of a quality internet connection, although the education development strategy defined the introduction of broadband internet in all households by 2020. As far as hardware resources are concerned, the largest percentage of students followed the classes on mobile phones through the Viber application. Students and teachers of equipped schools most often decided to use zoom applications in order to perform better.

Of the total number of accredited both state and private universities and vocational colleges, very few have accredited distance learning study programs. The Faculty of Organizational Sciences in Belgrade is in the lead in terms of distance learning. In addition to it, in the Republic of Serbia there is another number of state faculties that offer their students the availability of materials through various e-platforms. Precisely such platforms were used for material exchanges during the pandemic. Faculties such as the Faculty of Electronics in Nis (more precisely, the study program Computer Science and Informatics at this faculty) have decided to use Microsoft Teams tools. Regarding higher vocational schools, officially four higher vocational schools in the Republic of Serbia have accredited distance learning. High vocational schools that have moodle platforms can also be singled out as a supplement to the traditional way of learning. The organization of studies in higher vocational schools that are not equipped with the necessary equipment for distance learning during the covid 19 pandemic was reduced to communication between teachers and students via email, viber groups, zoom applications, etc. A number of private universities have accredited distance learning study programs. It can be said that private universities saw distance learning as a



chance to attract students. Some of them, in addition to the learning process itself, also perform knowledge test using online platforms. One of the universities where the process of teaching and testing students has reached a notable level is Singidunum University. Working with students and their testing process is accompanied by strictly introduced criteria that allow precise information on whether the student has independently created the tests. The parameters that are monitored during the tests refer to the duration of the test, the number of exits from the window in which the test platform is started, the student's focus on the window in which the test is performed (monitoring via camera). Similar parameters are monitored with Microsoft teams tools. The testing process refers to the preparation of tests that belong to the pre-examination obligations, while the exam in accordance with the Law on Higher Education is performed on the premises of the institution.

4. CONCLUSION

The use of information and communication technologies in the field of education has enabled and facilitated the availability of knowledge to a much larger number of people than is the case with traditional forms of education. The principles of distance learning, as well as the advantages of mobile applications intended for the education process, were especially evident during the pandemic of covid 19. In the Republic of Serbia, in the countries of the region and the world, distance learning was on a test during the previous months. Research has shown that the degree of success of this type of teaching as well as individual training through online materials available on different platforms depends on the technical equipment of teachers (schools and universities) and the technical equipment of course participants. Equipping primary and secondary schools with the information and communication equipment necessary for conducting this type of teaching, as well as the training of teaching staff in the Republic of Serbia, is still not at a satisfactory level. As far as universities are concerned, their equipment and approach to this problem are far better. Monitoring the development and progress in the use of mobile platforms in the educational process as well as opportunities for their improvement is one of the main goals of future research.

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