



M-LEARNING IN SERBIAN SECONDARY EDUCATION – A COVID-19 SIDE EFFECT

Veljko Aleksić^{1*},
Dionysios Politis²

¹University of Kragujevac,
Faculty of Technical Sciences,
Čačak, Serbia

²Aristotle University of Thessaloniki,
School of Sciences,
Thessaloniki, Greece

Abstract:

Learning represents a relatively permanent and progressive character of an individual's personality and behaviour change, and it arises as a product, i.e., the result of a specific experience. Modern digital technologies have further contributed to the improvement of learning. Some of these technologies have been developed specifically for educational purposes, but most had to be adapted to be suitable for teaching and/or learning. These communication and mobile technologies became crucial during the Covid-19 pandemic. The goal of this paper is to determine how current mobile technologies and devices can further be applied in secondary education and to analyse student habits and attitudes towards using mobile devices in secondary education in the light of returning Serbian secondary schools to traditional classes after a two-year-long state of a medical emergency.

Keywords:

Educational Technology, M-Learning, Secondary Education.

INTRODUCTION

Even though mobile devices permeated every pore of contemporary society during the last two decades, mobile learning (e.g., m-learning) was a novel approach to most of the teaching practitioners in secondary education who became painfully fast aware of its potential during the Covid-19 pandemic. The emergence of m-learning originated from e-learning as a way for learning on the go by taking advantage of every free moment in ever more saturated everyday routines of students. The concept of m-learning is still not clearly defined. There are several definitions of m-learning, one of which is that it represents any type of learning that takes place when the student is not in a predetermined place or that it is learning that takes place when the student uses mobile technology/device. However, m-learning can be broadly defined as the use of ubiquitous technology (devices) in combination with online access, to facilitate, support, enhance and expand the scope of teaching and learning.

Correspondence:

Veljko Aleksić

e-mail:

veljko.aleksic@ftn.kg.ac.rs



The possibilities of using mobile devices in education are diverse. Providing online access via 3G/4G/5G network has created very good conditions for the implementation of teaching and made it easier for individuals to access all the necessary information and services [1].

Due to its rapid development and accessibility, m-learning can be one of the key factors for the future development of educational technology and the improvement of learning/teaching processes. Of course, teachers play a primary role in the process of introducing and implementing any new educational technology. Their task is to observe and analyse the potential needs and possibilities of applying some new technology in the teaching process, primarily in their class. If they play it the right way, teachers will often make their work easier and (more important) they will enable students to learn experientially and gain new functional knowledge and skills. This research aims to analyse the current potentials of using mobile devices in secondary education, what students most often use them for and how, whether teachers already use them in their practice and what is their opinion on mobile technology's future potentials and development after experiencing teaching during the Covid-19 medical emergency.

2. RELATED RESEARCH

[2] [3] [4] observed that while most of the developed countries keep up with introducing new technologies and the applications of m-learning, Western Balkan countries still "drag their feet" when we think about the possibilities of using smartphones in secondary education. Researchers conducted a survey that included 9 municipalities, with 455 students and 49 teachers. Smartphones were most often used as a tool for gathering information but also for taking notes. Of the total number of respondents, 47% were male and 53% female. The age of the respondents ranged from 11 to 18. According to results, 72% of students owned a smartphone and 88% used it primarily for entertainment. Students generally used their smartphones to maintain communication (92%), but 63% stated that they benefited when tried using their smartphones for learning. However, this also had its downsides, namely 73% of examinees stated that they sometimes used their mobile device for cheating on tests. [5] also pointed out the need to use mobile devices for learning. Researchers believed that traditional learning has become very boring for today's students and that this boredom could be at least reduced by introducing the model of mobile

learning. In their work, [6] presented some advantages and disadvantages that accompany mobile technology. The research was conducted on a sample of 148 teachers, out of which 101 were in secondary schools. The survey was conducted through a paper survey. The age of the respondents ranged from 25 to 50. As for smartphones, 98% of teachers owned at least one, and 65% owned also a tablet. Most of the schools had the infrastructure necessary to use the Internet in classrooms. About 60% of teachers stated that they use smartphones in their classes. Paradoxically, 53% of teachers do not allow students to use their mobile devices during class. Male respondents were much more confident in themselves and their knowledge of using mobile technology than their female colleagues. [7] researched which mobile phones, applications and social networks students use, as well as the frequency of that use. As many as 92% of students always carried their mobile devices with them to school. However, 43% of respondents said that their mobile is always on but that they only look at it occasionally. It was recognized that the largest percentage of students used their mobile device for up to 3 hours a day, but there were 15% of respondents who used it for more than 5 hours a day. In most cases, students perceived m-learning as sending pictures of processed lessons to friends via their smartphones or finding information related to the lecture as well as reading books/files online. There are four applications that students used the most, namely YouTube (97%), Messenger (94%), Instagram (88%) and Facebook (80%). 94% of students used their smartphones to correspond with friends about class-related information outside of class. An example of an m-learning classroom based on the use of tablets was presented by [8]. Researchers reported that their approach was suitable for conducting tests and screen sharing, i.e., teachers used their own tablets to share the images they would traditionally share via projector or TV. [9] experimented by making a mobile game about the process of the circular movement of water. Namely, they divided the students into two groups of 19 students and gave one group a mobile device with a game that initially had a video about the movement of water in nature, and then the questions had to be answered. Another group of students attended traditional classes where they acquired knowledge about the same phenomenon using traditional methods. Later, they switched groups and compared how much the students learned using the mobile game, and how much the control group learned the traditional way. The results did not significantly differ, but a lot of time was saved when using mobile devices and students who used them were able to get



instant feedback. In one of the previous researches, there was talk about how it is possible to implement tablet technology in the teaching process so that it is of the greatest benefit to the teacher. In the research of the implementation of mobile learning in foreign language teaching on the example of German conducted by [10], it was found that the use of mobile devices had a positive effect on the quality of teaching and student achievements. The research involved 120 participants and it was found that over half of the respondents owned a tablet and used it once a week or less to find some information or for communication. According to researchers, the use of tablets had a positive effect on the quality of teaching by stimulating a creative atmosphere and the most significant advantage was fast feedback. [11] examined how much time students spend using their mobile devices and their favourite apps. It was found out that students used their mobile devices for approx. 4,5 hours a day on average. Based on this, they concluded that all previous tests on the ubiquity of smartphones were correct and that it has been confirmed that mobile technology will increasingly occupy young people. As for the applications that students used, it was mostly Instagram (42%), YouTube (26%) and Viber (5%). [12] stated that it was necessary to develop reliable tools and methods to properly implement m-learning. M-learning needs to form the conceptual basis that would give it certain credibility and authority in professional circles and that would be the good starting point for its evaluation [13]. [14] discussed the phenomenon of m-libraries and their social mission (which operate largely also as school libraries) attempting a correlation between the function of the welfare state and its obligations to citizens. [15] studied parents' preferences and beliefs towards using mobile technologies. Their study was conducted with 293 families in Greece which show that most of the parents had a positive attitude towards the use of these technologies. Parents wanted to support their children's learning and seek to provide a stimulating home learning environment for them. However, older and less-educated parents seemed unable to adapt appropriately to rapid technological progress and thus could not effectively exploit the advantages that m-learning have to offer to children. However, the positive attitudes of parents about m-learning are hampered by the lack of knowledge about the choice of apps with 'substantial educational value' as well as their use, particularly in the domestic environment.

3. METHODOLOGY

This research aims to present the current situation regarding using mobile devices and technology in secondary education and analyse future potentials. The research should determine whether and how students use their mobile devices, at what time of day, whether they think that mobile devices should be introduced in the teaching process, whether schools should allow and encourage the use of mobile devices, whether online hazard training should be introduced in the schools, etc.

The survey questionnaire used for the research consisted of 14 questions and 10 statements. The initial part of the survey and the first two questions referred to personal demographic data about the respondent and the rest of the questions and statements were related to the research topic itself. Questions were composed in such a way as to objectively represent the views and opinions of the respondent. The first part of the research was realized in the fall of 2019 (just before the Covid-19 pandemic) and the second part in the first quarter of 2022 after the Serbian secondary schools returned to traditional classes. The total number of respondents was 155 secondary school students from Serbia, all of which correctly completed the questionnaires. The largest number of respondents were third-grade students ($N = 96$), of which 62 were female and 34 were males. There were 30 first grade students, 14 males and 16 females, while 29 respondents were second-graders, out of which 13 males and 16 females. Of the total number of respondents, 20 lived in rural areas while 135 lived in urban areas.

In total, five hypotheses were stated: (General H0) Students usually don't use their phones for school purposes; (H1) Students most often use their mobile devices to reduce boredom; (H2) Students who live in the rural areas use their mobile devices less during the day; (H3) Male students were more likely to use mobile phones to cheat on tests; (H4) Female students most often used their mobile devices for accessing social networks.

4. RESULTS AND DISCUSSION

The questionnaire was validly completed by $N = 155$ respondents. $N = 61$ (39%) of the examinees were male respondents, and $N = 94$ (61%) of the examinees were females. Of the total number of respondents, $N = 20$ (13%) lived in rural areas (5 males and 15 females), while $N = 135$ (87%) respondents lived in urban areas (56 males and 79 females). In total, $N = 128$ (83%) students reported having a brother or a sister, and $N = 27$ (17%) had no siblings.



When asked "How many mobile devices have you owned so far?", one respondent answered that he has not owned any devices so far, three responded that they owned only one device, 12 responded that they owned two mobile devices and 139 students answered that they owned more than two mobile devices. When asked "How many mobile devices do you currently own?", one respondent said that he does not currently have any, 124 responded that they currently own one device, 15 responded that they currently own two devices and 15 responded that they currently own more than two devices. In total, 102 respondents stated that their smartphone runs the Android operating system, and 52 students stated that their smartphones were running the iOS. If we ignore the respondents that stated that they do not own a device, and we consider all others who use Android and iOS systems on their smartphones, we concluded that all students use modern smartphone devices.

Based on the results obtained from the t-test, there was no significant difference between respondents living in rural areas ($N = 20$; $M = 2.65$) and respondents living in urban areas ($N = 134$; $M = 2.75$). Based on the obtained results $t(152) = -0.530$; $p = 0.597$, it was concluded that hypothesis H2 has not been confirmed. One student that was living in the rural area and two living in urban areas stated that they used their smartphones less than one hour per day, $N = 9$ students that were living in the rural areas stated that they used their mobile devices between one and three hours per day, while the number of such respondents living in the urban areas was $N = 58$. By analysing the results in two time-frames (before and after the Covid-19 pandemic), we concluded that most of the students used their smartphones for up to 3 hours per day in both periods (67%). However, in the 2019 survey, 15% of respondents used their mobile devices over 5 hours per day, while this number has significantly risen in 2022 to more than 21%. Out of the total number of respondents, $N = 10$ respondents stated that they used their mobile devices mostly in the morning, $N = 32$ respondents stated that they used their mobile devices mostly in the afternoon, and the largest group of respondents ($N = 96$) stated that they used their mobile devices mostly in the evening. $N = 13$ respondents used their mobile phones primarily during the night.

When asked if they used their mobile phones to do homework, $N = 132$ (85%) students responded positively. When we observed students by gender, $N = 47$ were male and $N = 85$ were female. In total, $N = 16$ males and $N = 7$ females said that they did not use mobile devices to do homework.

When it comes to teachers and whether they use their mobile devices in classes, $N = 72$ (47%) answered that they were. A slightly larger number of respondents said that they did not use their mobiles in class, $N = 81$ (53%). When teachers were asked how often they generally used their mobile devices, most answered that they rarely used it $N = 87$ (56%). A smaller group of teachers did not use a mobile device whatsoever $N = 32$ (21%) and a slightly larger group used it occasionally $N = 34$ (22%). When we compared this issue with the previous one, we see that there is a contradiction. When answering the question, 32 students answered that their teachers did not use their mobile devices. Suppose that the students did not pay attention when they answered, it is possible that the students did not think that teacher used a mobile device if he/she used it to check what time it is, etc.

When students were asked what did they most often used the Internet for, $N = 146$ (94%) stated that it was for entertainment, while only $N = 9$ (6%) responded that they used it for school. If we take into account the gender of the respondents and the way of using the Internet, we could conclude that regardless of gender, the largest number of respondents used the Internet for entertainment, $N = 54$ males and $N = 92$ females.

When asked what students most often used their mobile phones for at school, most responded that they used mobiles for social networks, i.e., $N = 57$ (37%). The number of respondents who did not use their mobile devices in class at all was $N = 46$ (30%). $N = 29$ (19%) respondents said that they most often used their mobile devices at school for communication/correspondence, while the number of respondents who used their mobile for mobile games was $N = 19$ (12%). As expected, just $N = 3$ (2%) of respondents most often used their mobiles in school to acquire new knowledge. When we compared the gender distribution, $N = 43$ female respondents most often used their mobile devices for social networking, while the number of male respondents was $N = 14$. The largest number of male students ($N = 18$) did not use a mobile phone at all. $N = 28$ was the number of female respondents who did not use a smartphone in class. In total, 11 male and 18 female students used their mobile phones for correspondence at school. It was also significant that only $N = 5$ female respondents used their mobile phones for mobile games at school contrary to $N = 14$ male respondents. Based on the results, it can be concluded that students often used their mobile devices at school, although the school's policy forbids them. An increasing number of students were actively using



phones at school and in class. The percentage of such students was about 53% in 2019 while in 2022 it rose to a staggering 70%. Based on the t-test results, there was a significant difference between male students ($N = 60$; $M = 3.05$) and female students ($N = 94$; $M = 2.97$). Based on the obtained results $t(152) = 0.342$; $p = 0.733$, the hypothesis H4 that female students most often used their mobile devices at school for accessing social networks was confirmed.

When we questioned using mobile devices at home, the largest number of respondents said that they used their mobiles mostly for social networks $N = 91$ (59%). The number of respondents who used their mobile phones for correspondence was $N = 43$ (28%), and $N = 15$ (10%) students stated that they used their mobile devices at home for playing mobile games. As expected, we recorded the lowest number of those who used mobile phones to acquire new knowledge $N = 4$ (3%) while $N = 2$ (1%) students stated that they did not use their smartphones at home. We observed that both male ($N = 30$) and female ($N = 61$) respondents used their mobile phones mostly for social networking. The situation was similar with communication/correspondence, $N = 18$ males and $N = 25$ females. When it comes to playing mobile games, we observed that it was more prevalent among male respondents, about twice often. The result of the t-test shown a significant difference between male ($N = 61$; $M = 3.75$) and female ($N = 94$; $M = 3.71$) population. Based on the obtained results $t(153) = 0.346$; $p = 0.729$, it was concluded that the hypothesis H4 that female respondents most often used their mobile at home for social networking was confirmed.

One of the characteristic questions was "Have you ever used a mobile phone to cheat on a test?". The results should not be observed with complete certainty because students probably gave socially desirable answers. However, a positive answer to this question was given by $N = 46$ (30%) respondents, while $N = 108$ (70%) stated that they had never used their mobile phone for cheating at school. When we observed this result by gender, we concluded that $N = 22$ males have already used their mobiles to cheat on the tests, similar to the number among female respondents ($N = 24$). However, there were significantly more students who said that they did not use their mobiles for those purposes ($N = 69$ female and $N = 39$ male). According to the results obtained by the t-test analysis, there was a significant difference between male ($N = 61$; $M = 1.64$) and female students ($N = 93$; $M = 1.74$). Based on the obtained results $t(119,689) = -1,333$; $p = 0,185$, it was concluded that hypothesis H3

was confirmed - male students used their mobile phones to cheat on tests more often.

When asked if they think that using mobile devices could improve the quality of teaching, $N = 26$ respondents fully agreed so, $N = 43$ respondents generally agreed, $N = 34$ was undecided, $N = 22$ partially agreed and $N = 28$ strongly disagreed. If we analyse the gender distribution, we can see that the largest number of respondents mostly agreed with this statement, both male ($N = 18$) and female ($N = 25$). However, when it comes to respondents who disagreed, a difference was noticed, $N = 21$ females versus $N = 7$ males.

Regarding the use of mobile devices for teaching, students generally agreed with the statement, namely $N = 40$ of them. A similar number of students partially agreed ($N = 39$) and were undecided ($N = 38$). The smallest percentage did not agree at all ($N = 14$). When we observe it by gender, we detected one very important feature. The largest number of male respondents ($N = 18$) stated that they mostly agree with the statement, while females stated that they only partially agree with the statement. Based on these results, we concluded that male respondents believed more in this claim. In total, 24% of students agreed that mobile devices can improve the teaching process. Most students generally agreed with this statement $N = 50$ (33%). However, there were 22% ($N = 33$) of respondents who only partially agreed. However, when students' gender was analysed, $N = 33$ female respondents stated that they mostly agreed with this statement, while the majority of male respondents ($N = 20$) agreed with it. Although it was very important to pay attention, $N = 25$ students only partially agreed with this statement. Of course, the smallest number were those who disagreed with the statement.

Perhaps the most interesting claim was that access to the wireless network should be available in each classroom. As many as 60% ($N = 91$) of students agreed with it. There were significantly lower percentages of those who mostly agreed (20%), those who were undecided (8%), those who only partially agreed (7%) and those who disagreed (5%). The results show that the largest number of male ($N = 35$) and female ($N = 56$) students agreed with this statement. Based on these results, we concluded that the Internet has become something that young people living in modern society think that they cannot function without.

The next claim examined the support for the use of mobile devices by the school staff. We observed that the largest number of respondents $N = 47$ (30%) declared indecisive, 23% ($N = 35$) generally agreed with



the statement, and 20% ($N = 31$) strongly agreed. $N = 47$ respondents who were undecided in most cases were females. This is also the largest number of females who opted for this answer. On the other hand, the largest number of males ($N = 18$) generally agreed with the statement. $N = 54$ (35%) of respondents agreed that mobile devices should be used in computer science classes, $N = 33$ respondents were undecided while $N = 28$ respondents mostly agreed with the statement. There was the smallest number of those who disagreed with the statement $N = 18$ (12%). As with wireless internet, respondents agreed that mobile devices should be used in computer science classes. The largest number of males ($N = 21$) and females ($N = 33$) absolutely agreed with this statement. However, the next largest number of male respondents ($N = 17$) generally agreed, while the next largest number of females ($N = 25$) was undecided. When it comes to using mobile devices in other classes, the situation is a little different. The students were almost proportionally distributed, but still, 24% of them only partially agreed with this statement, 22% of the respondents mostly agreed with this statement and 20% were undecided. Based on these results, we concluded that the respondents were divided into two groups - those who were more inclined to use mobile devices in other classes and those who were not.

Of the total number of respondents, 40% agreed with the statement that training should be introduced in schools to learn about the dangers of the Internet and social networks. In addition, 28% of students generally agreed with this statement. This told us that almost 70% of respondents were aware that there were dangers on the Internet and social networks that should be learned in schools. It was interesting that the same number of male respondents ($N = 19$) stated that they absolutely agreed with this statement and that they mostly agreed with it. It was also interesting that the largest number of females ($N = 43$) agreed with this statement, while $N = 24$ said that they mostly agreed with this statement. Based on these results, it was clear that both male and female respondents were very aware that the Internet and social networks were not harmless.

It is known that a new practice emerged in modern times - when there is something that we do not know or we are not sure about we most often "consult" with Google search engine. This was indeed the case with sampled high school students, $N = 122$ responded that they agree with the statement that with the help of mobile devices and the Internet the answer to a certain question is faster and much easier. Significantly fewer

respondents ($N = 20$) said they mostly agreed with the statement, and only $N = 6$ reported they partially agreed. However, as expected, the smallest number of students did not agree at all. When we observed the gender distribution, we saw that males and females mostly agreed with this statement. Based on these results, we concluded that respondents were already widely using their mobile phones to find answers. When we added that students were aware that there were dangers on the Internet, we concluded that students were ready to learn how to protect themselves, but also how to find the right and relevant sources.

The last statement mostly referred to the use of a mobile device to reduce boredom. Out of the total number of respondents, $N = 71$ (46%) stated that they agreed with this statement, $N = 40$ (26%) respondents generally agreed that mobile benefits reduce boredom and $N = 19$ (12%) were undecided. When we took into account the gender, we saw that in this case, the largest number of respondents of both genders ($N = 25$ male and $N = 46$ female) agreed with the statement. In addition, there was a large number of respondents who mostly agreed with the statement ($N = 19$ females and $N = 21$ males). The t-test analysis returned values of ($N = 61$; $M = 4.00$) and ($N = 94$; $M = 3.95$) for male and female students, respectively. Based on the obtained results $t(153) = 0.267$; $p = 0.790$, it was concluded that hypothesis H1 was confirmed - students most often used their mobile devices to reduce boredom.

Based on the results and confirmed hypotheses, we concluded that the general hypothesis H0 was confirmed - students usually don't use their phones for school purposes.

5. CONCLUSION

Even though the digitalization of modern society is a process that began several decades ago, we are still witnessing the accelerated development of information and communication technologies. Today, life and education became impossible to imagine without the possibility of long-distance communication at any time, especially during emergencies, such as the Covid-19 pandemic. Young children are already well acquainted with mobile technologies and devices and handle them very well. Our research confirmed that most high school students have smartphones or some mobile digital device. This represents a challenge for the school system itself, which definitely needs to find more ways to apply and use all this alternate power. Most high schools still completely



forbid using mobile devices in class, but there are more and more examples where teachers start encouraging students to use their smartphones if they see that they can be used in the right way. However, this research has proven that students often abuse the technology, for instance when cheating on tests, and that is why the beforementioned school restrictions can be, in a way, justified. In addition to that, students found a way to apply mobile technologies in the process of acquiring knowledge by using them to do homework. It is clear that generations born in the 21st century grew up with social networks and most often they are not completely aware of their dangers. The integration of mobile technologies in schools is a necessity and an inevitability. It is an innovative technology that should already be in use. Due to the growing possibilities of free online access, the following question arises: "Is it really necessary for students to know every detail of every lesson by heart when they can access it all in just a few seconds using their smartphones?". This can be a problem with this technology paradigm. Hardware resources are also becoming problematic because it is becoming necessary to procure all the equipment for the classes to be carried out according to the desired plan. However, these costs will surely be reduced because as proven by this research, students in most cases already have newer generation smartphones that surely can be used for these purposes.

Creating a subject curriculum that includes the use of mobile learning and technologies is very difficult because of the constraints of the traditionally framed educational system. Modern schooling and education are facing great difficulties. Even if we could ignore the mobile learning model, there are more and more new technologies that also allow students to get instant information. Additionally, a significant number of teachers are not sufficiently familiar with the possibilities nor trained to implement mobile devices/technologies in their teaching practice and were mostly left to improvise during the covid-19 state of emergency. Therefore, if we want to ensure, advance and further integrate technology into secondary education, the first step should surely be to train and employ digitally literate, skilled and competent teachers who have the power, desire and will to take the next step into the digital future.

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