Teachers' Perspective on Integration of Mobile Solutions in Romanian Undergraduate Education System

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The purpose of this paper is to present the attitude of teachers from Romanian undergraduate education system towards digital solutions in the COVID-19 era and post COVID-19 era. Moreover, one of the main objectives is to analyze teachers' openness to the further integration of mobile solutions in Romanian undergraduate educational system. This paper relies on a case study about the way digital solutions were integrated in the teaching process during the pandemic and if and how they will be integrated in the post COVID-19 era. The data was collected through a questionnaire spread among teachers from all the levels of undergraduate educational system. After the analysis, it was identified that digital solutions were a great help to undergo the teaching process during the pandemic and, once discovering their benefits, the teachers are willing to further make use of them. Nevertheless, it is teachers' strong belief that the traditional educational system can never be totally replaced by an online/mobile-based system, but that the two can coexist for the improvement of the pupils' education and engagement. Overall, this paper contributes to the literature by offering an insight of the way digitalization of Romanian undergraduate education systems is viewed by one of the main actors of the learning process, the teachers. While digitalization in university context was highly discussed, the undergraduate context was not paid the same attention and this study aims to increase the awareness that the undergraduate educational system needs solutions for digitalization too.
Keywords: *Mobile Solutions, Romanian Undergraduate Education, M-Learning, Digitalization, Learning Experience, Technologized Educational System*
DOI: 10.24818/issn14531305/25.2.2021.07

1 Introduction

The breakout of the COVID-19 pandemic last year and its rapid spread challenged all activity domains and forced them to adapt to a completely new context, where digitalization played an important role. Probably one of the most summoned domains was education, which, in this unforeseen new context, had to move the entire learning process to a complete online one [1], maintaining however the quality of the educational act. Therefore, digital solutions that encourage collaboration and material sharing and offer a flexibility to the learning process were brought into the attention of teachers, students and parents [2], but the infrastructure was not the most suitable.

The digitalization of the Romanian education system is not a new topic. Even if, compared to other countries from the European Union in terms of digitalization, Romania ranked only 26th out of 28th [1], throughout the years, it has been of particular interest. Many recent studies have already focused on finding different digital solution to be integrated in the system so that the lack of infrastructure and IT knowledge among teachers, students and parents [3] can be overcome. Over the years, many Romanian universities have developed and successfully assimilated in the learning process different e-learning solutions [4], taking advantage of all their benefits. However, little attention has been given to the way the undergraduate education system could integrate e-learning and m-learning. Studies have shown that the usage of e-learning was extremely low before the pandemic [3] and the massive usage of digital solutions started with the date of March the 15th 2020 [5], once the pandemic forced the schools to close.

Thus, the primary focus of this paper is to perform an analysis of the way digital solutions have been integrated in the educational act at the level of undergraduate education system during the pandemic and if it had any impact

on the educational process. This study will cover teachers' perspective, since they are the ones who master the teaching techniques and can draw attention to the flaws or the benefits of integrating technology in the teaching act. Moreover, this study also attempts to answer another question: are teachers willing to a permanent introduction of mobile solutions once the pandemic is over and the schools can resume to their original schedule?

In order to meet the objectives of this study, a survey was applied to teachers from the Romanian undergraduate education system from all levels (kindergarten, primary school, secondary school and high school). This survey included mostly Likert-type scale questions, as well as control questions regarding age, type of educational institution. A total of 85 responses were received in this survey.

Therefore, this paper is structured as followed: introduction, literature review with the focus on advantages and disadvantages of online education, research methodology, results, discussions and limitations and conclusions.

2 Evolution of distance education

Once the COVID-19 pandemic started, the traditional face-to-face educational activity had to be interrupted and the entire educational process was transformed into a distance one [6]. Everyone involved in the learning process (teachers, students, parents) had to immediately adapt to the new unforeseen context [3]. From teachers' perspective, this transition implied a whole redefinition of practices, modalities of communication between parties and, not lastly, content and teaching methods [6]. The change was not easy for students and parents either. Since all the activity moved at home (school in the case of children, work in the case of parents), it was primarily difficult to cope with the lack of a dedicate study place. Moreover, for being able to attend online classes, pupils needed a device (either a smartphone or a computer with Internet access) at their disposal and, due to different reasons (such as the financial status of every family or the number of electronic devices they owned), many of them confronted with a lack of infrastructure and impossibility to have access to education [3].

Nevertheless, the idea of distance learning was not born in the digital era. It started to be discussed since the 1900s [5]. The first forms involved education through radio and, in 1945, by television [5]. Over the years, encouraged also by the technological evolutions, new distance learning opportunities have been developed. The breakthrough was concomitant with the emerging of the Internet and the development of e-learning. Due to its characteristics, one can say it was a real revolution in terms of educational initiative. The flexibility that it brought to the world of courses is a very important fact to be mentioned [2]. Alongside its entry, the learning time has drastically changed because the educational process was no longer linked with a certain period of time. Its location has also become relative, e-learning being possible anywhere, a key aspect in the context of a pandemic.

In addition, an important benefit of e-learning is the huge and rapid access to learning content [7]. E-learning also offers different types of content (from text to image and video) [7]. The collaborative approach is introduced with e-learning too [7], students and teachers being able to communicate via different technological methods such as chats or discussion boards.

But, despites all the benefits of e-learning, one of the major throwbacks is, in the context of a pandemic, that they are mostly computer-based applications [2]. So, there is the limitation of having a computer [8] with Internet access, whether if it was a wireless connection or based on a certain network infrastructure. Studies showed that, during the COVID-19 era, the students lacked this infrastructure and used mainly smartphones to participate to classes [3]. So, the necessity of availability anywhere and anytime without any infrastructure constraints was one of the most important requirements. Another condition was content adaptation to a smartphone device, mainly taking into consideration the size of the screen. These conditions can be met by m-learning, which is supported by the spread of mobile technologies in the recent years [9]

[10]. M-learning means in essence the learning that exploits the mobility [11], which could indeed be helpful in a pandemic context. Apart from the flexibility and the availability mobile solutions bring to the educational process [12], m-learning has more benefits. Due to the way mobile devices are built, they are, firstly, lighter [9] [12] and secondly equipped with different features (such as camera, sensors, microphones) that can increase the learner's interest [13] until an extend in which the learning process becomes a game-based learning experience [13]. Therefore, taking advantage of all the inbuilt characteristics of a device, the teacher can integrate this technology in almost any type of pedagogical methods [8]. Moreover, by introducing mobile solutions into the education sector, the costs will be reduced [9]. There will be no need of dedicated space for a computer laboratory or of IT specialists who will provide with support [9].
However, m-learning comes with some throwbacks that make its integration in the education system more difficult. First of all, studies showed that neither teachers' confidence, nor students' confidence in this type of solutions is very strong [14]. A huge number of actors of the learning process still prefer the traditional face-to-face approach. Even if the device is equipped with a series of sensors that can be incorporated in the learning, it also comes with some limitations in terms of memory and battery autonomy [15]. These constraints can affect, on one hand, the flexibility and mobility that characterizes m-learning and, on the other hand, can make the device more vulnerable to security threats [16], especially related to data privacy security [17]. Additionally, it appears that there are certain age groups that cannot benefit from m-learning [18]. In this category, one may include the children who are less than ten years old since they need assistance in the learning process [18] and they do not own a mobile device. So, in this scenario, the mobile device becomes just an instructional tool [19] for content sharing.
Besides its role as an instructional tool, the mobile device can be also used for communication between the parties, becoming thus a supportive tool. Moreover, it can assist the evaluation process, as an assessment tool [19]. So, the integration of mobile solutions can indeed support the evolution of the educational system, but teachers' openness to the integration of new technology is essential.

3 Research methodology

This study focuses on an analysis of the way technology was introduced in the educational act during the pandemic, as well as the teachers' openness to a further usage of the mobile solutions once the face-to-face activity will be reprised. It consists of a descriptive survey based on a questionnaire analyzed from the perspective of teachers, since they have the knowledge and experience to identify the best approaches in integrating the technology into the teaching activity. It uses a quantitative research method using a random sample population of 100 Romanian teachers from all levels of undergraduate education system.
The questionnaires were sent via social media means or by e-mail and a number of 85 responses were received. There were some conditions to meet when the cross-section was selected. Firstly, the teacher must teach in the Romanian undergraduate education system, taking into consideration the main objective of this paper. Thus, although university teachers represent an important part of the Romanian education system and their opinion on the subject might be extremely valuable, no response from them was intended. So, an eliminatory question in the survey was related to the level of undergraduate school the teacher activates. Secondly, the age group was also relevant. The teachers selected for this study were at least 21 years old, even if the minimum age of teaching can be 19 years old. This condition was imposed due to the need of a minimum teaching experience (and all the respondents had at least two years of experience in the field). However, there was no condition related to school's affiliation or to school's environment, but the study included these aspects as well in order to try to offer a broader and a more correct image of the Romanian education system as a whole.

The questionnaire, divided in three sections, was anonymous and consisted in single and multiple-choice questions, as well as an open question. The first section was dedicated to collecting personal information about the respondents: the level of undergraduate educational system they belong to (kindergarten/ primary school/ secondary school/ high school), the age interval, the environment of the educational unit – urban/rural and its type of affiliation – public/private. The second section covered the way the undergraduate education system coped with the pandemic from a technological point of view. There were seven questions about the digital solutions and devices teachers used during the COVID-19 era. The third and last section gathered data about the way teachers perceive the permanent integration of mobile solutions in the teaching process in the post COVID-19 era.

The distribution of questionnaires and the answer collection were made in June 2021. The 85% response rate is accurate and expected for this kind of surveys. The data collected was analyzed and presented using pie charts, histograms, frequency distributions and statistical tests. According to Fig. 1, most of the participants were teachers at high school (37, 44%), followed by teachers at kindergarten (22,26%). The lowest percentage is represented by the teachers that teach at primary school (only 7,8% of respondents). Even if the distribution of percentage is not uniform, the eclecticism is undoubtedly useful for the data collection. The study covered all levels of undergraduate systems, so the image is completed and, from this point of view, one may claim that the cross-section is representative. The lack of respondents from one or more levels would have had an impact on the accuracy of the aspects analyzed by this paper.

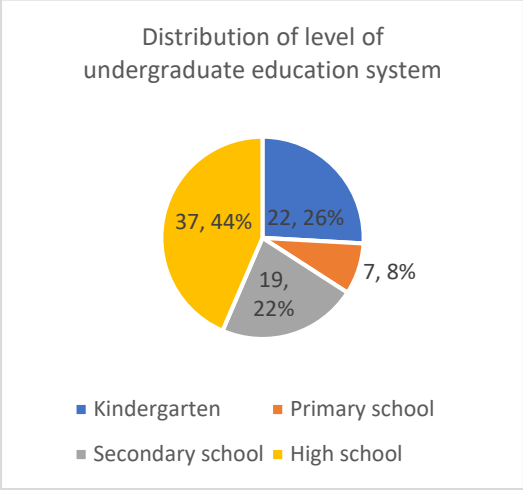

Fig. 1. Distribution of level of undergraduate education system among respondents

To obtain even a clearer profile of the respondents, the age distribution (that can be found in Picture 2) was realized. The majority of the teachers that participate to the survey belong to the 41-50 years group and the lowest group was represented by the teachers that are more than 60 years old. These results brought to the attention the fact that the undergraduate education system is dominated by teachers that belong to the age group 41-50, a rather elderly population than one might expect. The fact that teachers that have more than 60 years old participated to the survey might incline the balance to a certain perspective, as their age is not equivalent to the usage of technology in Romanian society.

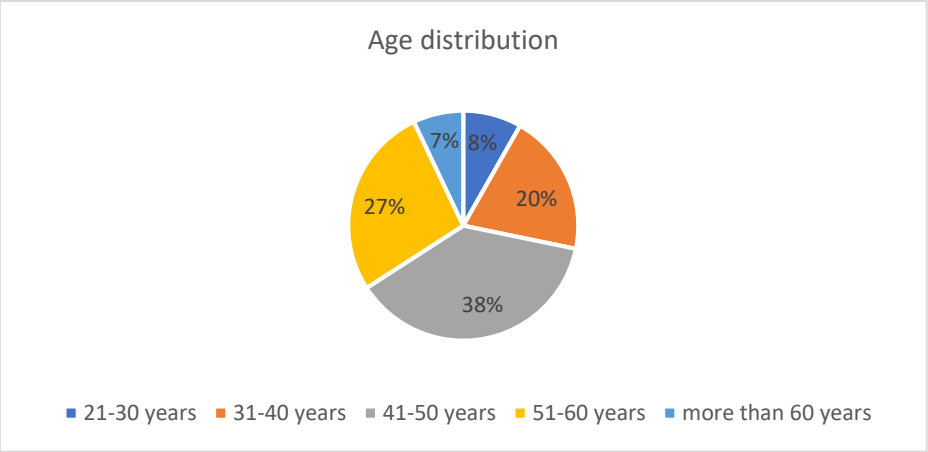

Fig. 2. Age distribution among respondents

A huge number of the respondents work in an urban zone from Romania (as one can identify in Picture 3) and they work in the public system of education (only 2 teachers that work at private schools in Romania answered the questionnaire). This variable is important for the study because, as studies shown over the years, the most disfavored schools were the ones in the rural areas. Those schools suffered from lack of infrastructure and technological integration, so teachers from these areas are even more representative for this study as their challenges are greater.

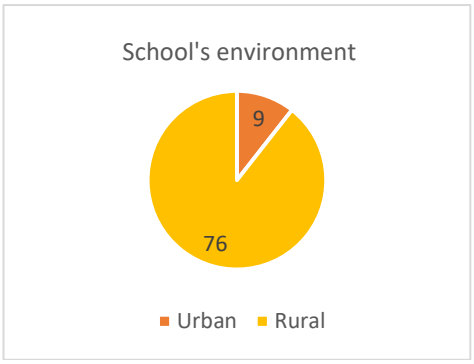

Fig. 3. School's environment

The fact that the school's affiliation is so strong oriented to the public education system (only 2% of teachers were affiliated to private schools, as shown in Fig.4) represents an advantage since most of the Romanian pupils frequent a public school and this is the environment that needs a significant change.

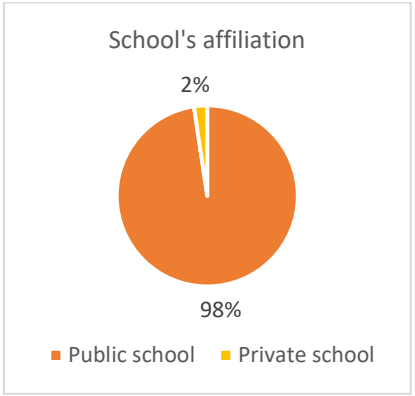

Fig. 4. School's affiliation among respondents

4 Results

4.1. Romanian undergraduate education system during the pandemic

One of the objectives of this paper is to draw the image of the undergraduate educational system during the COVID-19 era. According to the respondents, in this period, the teaching process did not lack the integration of digital solutions. 100% of the respondents admitted the usage of different digital means to cope with the rapid and unforeseen change.

Since the distance education can be helped by several categories of methods, the teachers were presented five categories to choose from according to what they have used starting from March 2020. These categories were educational platforms (such as Google classroom, Moodle, Edmondo, Easyclass), social networks (like Facebook or WhatsApp, as a mean of sending materials), mobile applications (for instance Kahoot), phone conversations (as a communication mean to send instructions) and indirect communication (for example, asking a colleague / parent to send materials and instructions to pupils). Fig. 5 presents the distribution of usage of different method, according to age. It resulted that the most used method was represented by the educational platforms (80 responses), almost all age groups preferred this method, except the group 21-30 years, where social networks was the most used method.

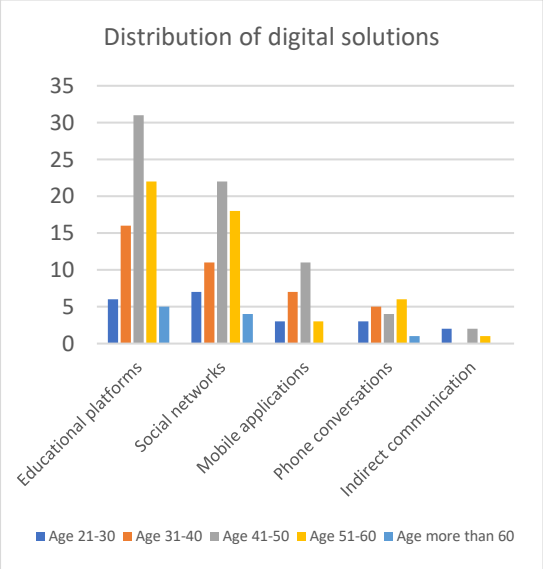

Fig 5. Distribution of digital solutions used by teachers according to age group

A very low number of responses was recorded for indirect communication, proof that the teachers wanted to maintain a close relationship with their pupils even at distance.

Mobile applications seemed to be very popular among the age group 41-50, but there was no teacher that participated in the survey and belonged to the age group of more than 60 years that used mobile applications during the pandemic.

The choice of using educational platforms is strongly related to the teaching method. A huge percentage of 97.6 respondents stated that they had, as a main teaching method, online courses organized on different platforms (such as Zoom and GoogleMeet), another proof that the teachers wanted to stay engaged. Another teaching method was sending materials via e-mail, used by 17.6% of the teachers.

Therefore, one may claim that, during the pandemic, the teachers really integrated technology in the teaching process, even more than they used to do before, being forced by the circumstances. Nevertheless, when asked to evaluate how much the digital solutions helped them, less than a half (48.2% as show in Fig. 6) stated that the technology helped them very much, 28.2% that it was somehow helpful. 18.8% evaluated the integration of digital solution as neither helpful nor useless.

There were also 2 teachers that considered that technology didn't help at all.

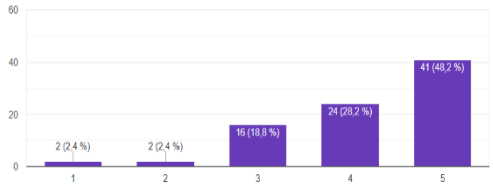

Fig. 6. Teachers' opinion on the helpfulness of digital solution during the pandemic

Another important aspect covered by the second section of the questionnaire was discovering teachers' openness to further integrate the digital solutions used during the pandemic once the face-to-face activity will be reprised. As per Fig. 7, a huge number of teachers saw the advantages of technology in education and will continue to make use of the solutions. However, there is a percentage of 14% (12 teachers) among the questioned teachers that responded negatively. 12 is a considerably big number of teachers that opposed to the further usage of any kind of technology.

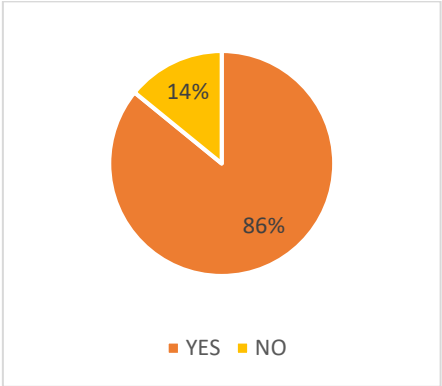

Fig. 7. Teachers' opinion on the further integration of digital solution

4.2. Prospects of m-learning integration

Another objective of this research was to identify teachers' eagerness on permanent introduction of mobile solutions in the education system.

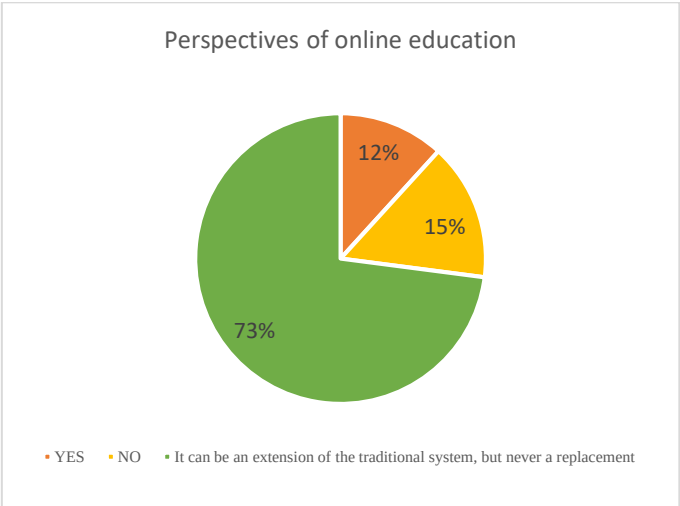

Fig. 8. Perspectives of online education in teachers' opinion

Thus, teachers were asked about their opinion on online education as an alternative to today's traditional education. According to Fig. 8, only 12% agreed that the traditional education system can be totally replaced by an online approach, whereas 15% stated the face-to-face education can never be substituted by online education. A huge number of interviewed teachers (73%) chose a more inclusive strategy in which the two approaches coexist.

Even if the percentage of teachers that believe the online education can represent an extension of the traditional education or a replacement is so large (85%), the perspective of introducing mobile solutions is not so welcomed, as shown in Fig. 9. Only 66% of teachers that took part in the survey considered that m-learning could be a helpful addition to the education in the undergraduate system.

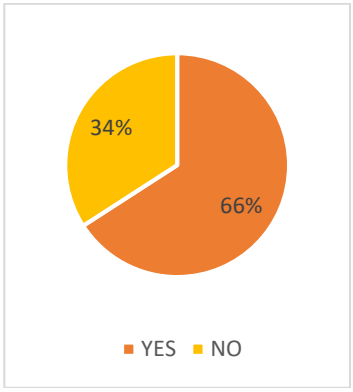

Fig. 9. Teachers' opinion about introduction of m-learning solutions

Fig. 10 offers a view on the advantages m-learning can bring to the undergraduate education system in teachers' perspective. 54 teachers sustained that the main benefit of m-learning will be that the courses will be more attractive. On the second position there is the idea that the integration of m-learning solutions can increase pupils' motivation. Cost reduction of didactical materials and compensation of the lack of laboratory equipment can also be considered as benefits according to the huge number of responses. Nevertheless, there is a significant number of teachers (16) that considered that m-learning cannot bring any benefit to the educational system.

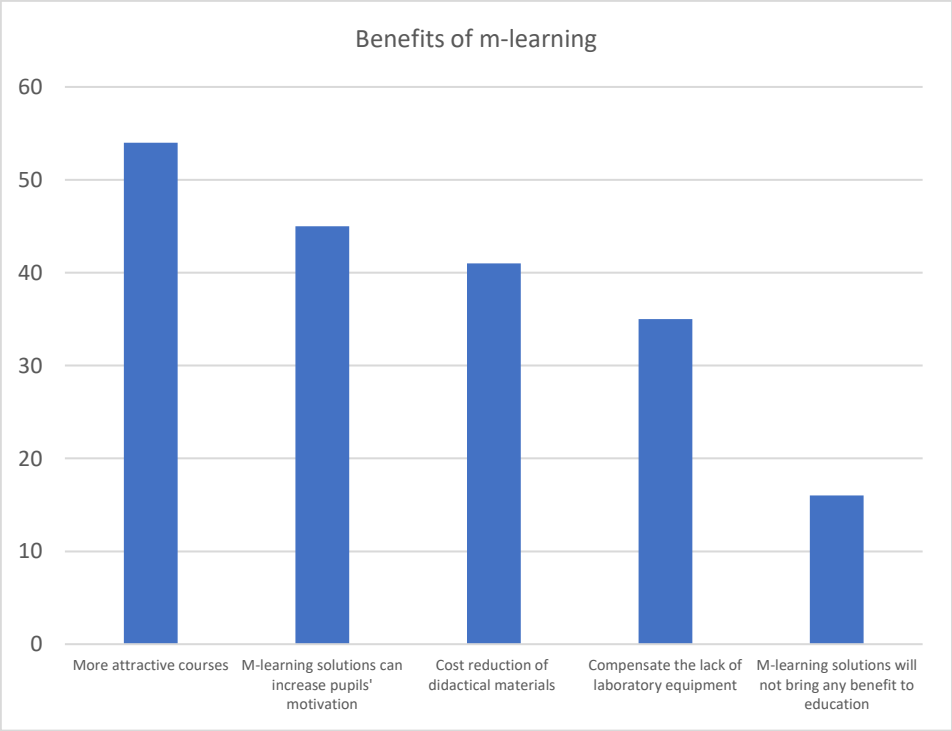

Fig 10. Benefits of m-learning in teachers' opinion

The teachers that took part in the survey were also asked about the level from undergraduate system where m-learning can be successfully integrated, and the results are shown in Fig. 11. A significant number (72) claimed that the most adequate level will be high school, whereas the less suitable will be kindergarten. Integration at primary school is considered not so appropriate, having only 8 responses more than kindergarten. Secondary school as an adequate level for m-learning seems to be an option in teachers' opinion, obtaining 46 answers, but positioning at a considerable difference in relation to high school. So, fig. 11 also shows that the age is extremely relevant when deciding to use m-learning solutions in the teaching act.

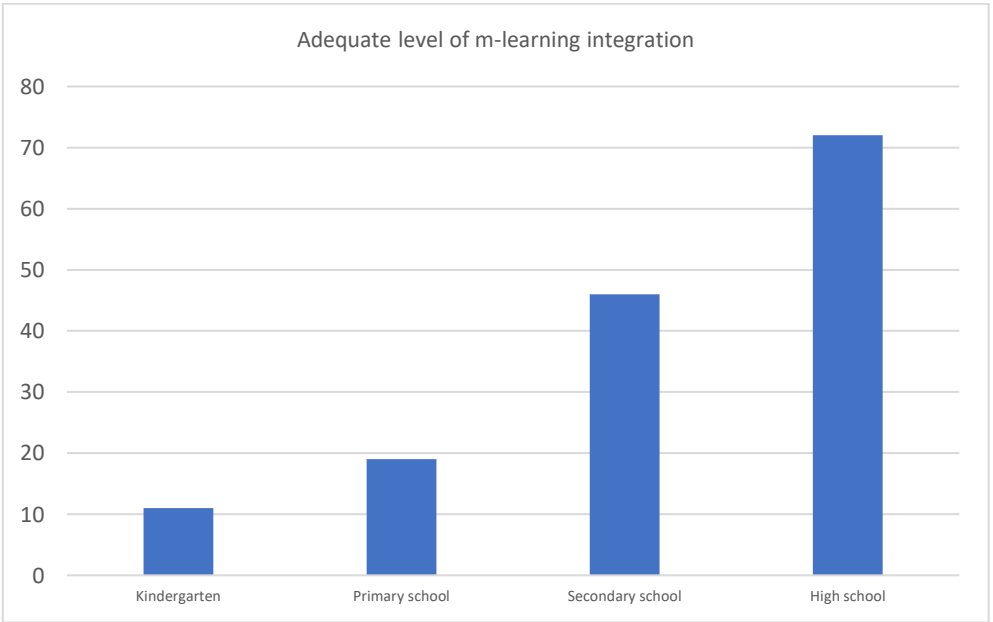

Fig. 11. Adequate level of m-learning integration

As a final thought, the last question of the survey covered the topic of sufficient digital skills among the teachers in the undergraduate education system. The majority, as depicted in Fig. 12 (69%), considered that they did not have enough digital skills and there is a real need of dedicated trainings so that their skills in working with the computer and choosing the right digital materials could be improved. However, the percentage of teacher that consider that their digital skills are enough (31%) is considerably high if one thinks of the low level of digitalization in the system.

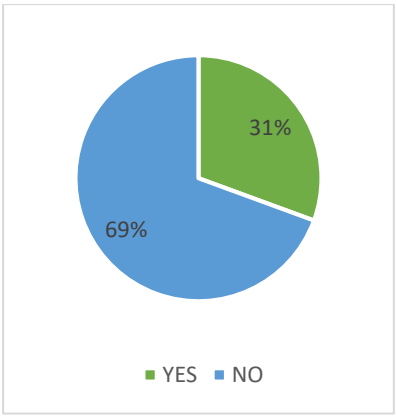

Fig. 12: Teachers' opinion on the level of their digital skills

5 Discussions

The perception of teachers remains extremely important in the adoption of mobile solutions in the undergraduate systems. They have the knowledge and the didactic skills to better understand where and if mobile innovation can really be benefic to the Romanian education system. Thus, this paper firstly focused on the relationship teachers had with technology of any kind during the pandemic. As expected, all teachers used digital solutions in the COVID-19 era, but it seems a decision based more on the circumstances (the fact that all activities were moved in an online environment) more than on a personal preference. This idea is highlighted by the 14% teachers that stated they would not further integrate technology once the pandemic is over.

However, the positive impact of the digitalization was perceived among most teachers. They seemed to have discovered, during the pandemic, digital solutions they had not previously worked with. It also appears that they did not limit the meaning of digital solutions only to visual documents (like Power Point presentations) or typed documents that are sent via an online mean (such as email or WhatsApp), but they explored a suite of applications and platforms in order to find the most suitable solution to their needs. They also expand the idea of digitalization by bringing into discussion the idea of smart blackboards, video projectors so that the courses can become more engaging and very similar to a game. The idea of education based on gamification is also sustained by [13].

Another aspect that needs to be brought to the attention is the relation between teachers' age and their power of adaptability. The age was not an impediment, as one might think, of adapting rapidly to the new context. The usage of educational platforms among the age group of teachers over 60 years is extremely favorable, as well as their choice of not using indirect communication methods to reach their pupils. This result supports the idea that, even if the educational system is not dominated by young teachers (only 8.2% of the respondents were part of the age group 21-30), who are more accustomed with the technology, its integration is still possible due to teachers' power of adaptability.

Nevertheless, the important question is whether teachers are willing to integrate technology on their daily teaching process. This aspect does not seem so favorable, as the

results obtained by the survey are also supported by [14]. The lack of confidence, as well as the security threads of m-learning in relation to data management, sustains a rather reticent attitude. Moreover, this lack of confidence may also be asserted to teachers' opinion that their digital skills are not sufficient and they need more training, centered on efficient solutions to be integrated in the teaching process. During the pandemic, even if all teachers had to adapt to a digital world, they learned by themselves and tried different digital solutions that they evaluated as being the most appropriate, without having the necessary technical expertise.

The study also confirmed several ideas presented in papers [9] and [13] in terms of benefits of m-learning in the education system. As shown in Fig. 11, the idea of costs reduction by adoption of mobile solutions discussed in [9] is considered by a significant number of teachers. However, the main benefit of m-learning, according to teachers, still remains their feature of making the courses more attractive. This study also points out other two benefits of m-learning as a mean to increase pupils' motivation and a mean of compensate for a poorly equipped laboratory.

The drawbacks of m-learning are also confirmed by the survey. Paper [18] brought to light the idea that there are pupils of certain age groups (such as the ones from kindergarten) that cannot exploit entirely the advantages of m-learning. This idea is demonstrated by Fig.11, where teachers express the concern that mobile solutions might not be adequate for kindergarten pupils because they need assistance in the learning process. However, the fact that 11 teachers claimed that m-learning can be used even at kindergarten level supports the idea that mobile devices can become an instructional tool. The teachers can use the mobile device and mobile applications for content sharing by showing videos on certain topics to children under 6 years old.

6 Conclusions

The COVID-19 pandemic was a real challenge for the educational system, forcing a completely and rapid transformation from a face-to-face traditional learning to a completely online approach [6]. The need of adaptation was a must during this period and finding alternative solutions was a primary concern [3]. Digital solutions integration came as a natural and obvious tool, taking advantage of all the benefits they offer.

This paper firstly offered to its readers a brief introduction of what the pandemic period meant for the education system, as well as how the education system previously coped with digitalization. Then, it presented some advantages and disadvantaged of both e-learning and m-learning solutions as being the obvious choices during the pandemic.

However, this study wanted to offer a larger perspective of how teachers perceived the sudden change in the education system because of the pandemic, as well as establishing whether teachers from Romanian undergraduate system are willing to a permanent usage of mobile solutions after the COVID-19 era. On one hand, the results confirmed both the positive and negative aspects of mobile solutions in the education system identified in the literature study. Nonetheless, even if the teachers understood the benefits of digital solutions during the pandemic and made use of them, it was rather a need more than a personal initiative.

Moreover, this study reinforces the fact that mobile solutions are a tool that can be successfully used more for older pupils (especially the ones in high school) since they are more independent learners and they do not need so much assistance as the younger pupils.

This study has, however, a series of limitations. Firstly, the number of teachers who teach in schools from rural areas was extremely low, only 10.6%. The results may be influenced by the fact that the level of digitalization and Internet access is broader in urban zones. In addition, teachers from rural areas might not be so willing to integrate mobile solutions in their daily teaching since they lack the infrastructure. Secondly, the fact that the predominant school affiliation was public can influence the perspectives since private schools can follow different curricula than public schools and can benefit from a more

modern and complex equipment. But the cross-section is still relevant, having representatives from all undergraduate levels that expressed their view on the digitalization of the education system.

Based on these results, this paper confirms that most of the teachers are open to further use digital solutions with a focus on mobile ones, but more interest should be firstly invested into dedicated trainings for teachers to understand the role of every application so that they can better choose according to their needs.

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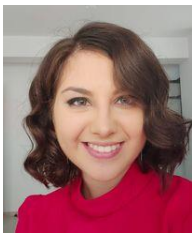

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