

## M-learning and E-learning Educational Solutions Impact in the COVID-19 Pandemic

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*In the two years the world faced an unprecedented crisis, the emergence, and the rapid spread of the COVID-19 virus. The situation has transformed in a pandemic which led to an accelerated digitalization of many businesses and services, including teleworking and video conferencing, access to healthcare and education. The education sector is one of the many sectors impacted by this crisis where many students of all ages had to adapt to the situation. The study includes a detailed analysis of m-learning and e-learning and their usage in several countries in the educational area during pandemic. In this paper it is analyzed the impact of the COVID-19 pandemic in different countries over the education sector, the importance of the online learning and we provided a short glimpse on how the governments handled this situation in terms of measures took in this unique and unpredictable case. The study compared the situation in multiple countries in terms of digital presence and access to learning. The implications of the study might be helpful for decision makers in developing further e-learning and m-learning solutions to be used in crisis situations to prevent all the shortcomings registered in this pandemic and to propose actions to be followed to guarantee students' access to education. The findings of the study reveal that although there is a rapid spread of the technology worldwide that was used to organize the education process on short term, there is still a high number of students with lack of access to education if the pandemic will continue for many other months, or in the case when a similar scenario might ever occur.*

**Keywords:** Education system, COVID-19, m-learning, e-learning

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### 1 Introduction

In the last two years, the entire globe has faced a unique situation due to the rapid spread of a new virus called COVID-19, with the cases reported first in December 2019 in Wuhan [1]. This virus triggered a global pandemic that kept humanity at home for several months in 2020. Now, almost 619 million cases of COVID-19 are registered, and it is still growing. Globally, there have been almost 6.6 million deaths and 599 million people who have recovered from the virus [2].

One of the measures adopted, the isolation, influenced the change of the operational activities in many sectors all over the world. All the consequences of the pandemic are yet unknown but most likely these will influence the society in the long run.

During this period, all sectors of activity were affected, one of them is the educational sector. This crisis has created most likely the largest

disruption of education systems in history. This pandemic affected more than 1.6 billion students, in more than 190 countries on all continents. This led to closing schools and colleges, impacting 94% of the world's students from low and lower-middle income countries [3].

Most governments have decided to temporarily close their educational institutions to limit the spread of the COVID-19 virus. Thus, the students had to stay at home and start taking online classes until the beginning of the summer vacation when the school or university semester ended [4].

In the past, the technology development was often considered as an alternative for the traditional education. In the context of this crisis, the orientation toward the digital environment has proven to be both an opportunity to grant access to education resources, but also a challenge for governments, individuals, teachers, and

families. The entire system has switched from the traditional orientation to the online education system based on eLearning [5]. Although it can be considered as an alternate solution during this period, to protect the individuals against the spread of the virus, the online education, poorly managed or implemented, due to emergency without taking into consideration all the involved factors, has determined also quality issues.

This COVID-19 pandemic reduced the educational opportunities for many vulnerable children and adults – those who live in poor or rural areas, refugees, and persons with disabilities. This crisis threatens decades of progress while 23.8 million students may drop out or not have access to school due the pandemic [3].

The pandemic has tested the educational infrastructure in every state of the world. Some dealt with this problem very easily, being already prepared with online teaching methods, and others had great difficulties because they were dependent on normal teaching [4]. An analysis of the government's response to the challenges encountered in the educational area in this context is therefore necessary. More precisely we would like to emphasize the role of the m-learning and e-learning in guaranteeing the access to education in such an unpredictable and unforeseen situation caused by the pandemic. The study focuses on comparison between the countries in terms of adopted m-learning and e-learning solutions and indicators available to describe the current situation. In this paper we will analyze the impact of the COVID-19 pandemic in different countries over the education sector and what alternate solutions were provided.

The following section includes a review of the literature regarding the online education through dedicated solutions (e-learning and m-learning) and other chapters describing how electronic courses were implemented from the beginning of the pandemic. A methodology section was also included, where several countries are analyzed from this perspective. At the end of the paper the in the sections results and conclusions we draw a

line and conclude about the impact of the m-learning and e-learning in the crisis generated by COVID-19.

## 2 Literature review

In the current context of technological development, conventional and non-conventional methods of teaching can now be joined by other non-conventional methods, much more adaptable to rapid progress, one of these methods being known the notion of e-learning. The notion of learning through electronic devices can be defined as a form of formal or non-formal education with established learning objectives, where the interaction between participants is facilitated by information or communication technologies [6].

E-learning is most often encountered in distance education, its evolution being closely linked to the progress of information technology. The term was introduced in 1998 by Jay Cross and has since become widespread, being seen as an innovative method of learning through electronic tools. An e-learning system is represented as a learning experience, with educational resources on an e-learning environment succeeded in a logical order, to be assimilated without group constraints [7]. In the last fifteen years, e-learning has become a viable alternative to traditional teaching practices, being implemented in more and more institutions. For example, a virtual university has been set up in Barcelona, with an academic environment of over 55,000 students) [8].

The notion of m-learning (through mobile devices) comes as a natural extension of the broader notion of e-learning (through electronic devices). The main difference is the higher degree of availability and accessibility that can be achieved using a learning environment through mobile devices. The implementation of this notion brings substantial benefits to the quality of education within the entire community (teachers, students, or parents).

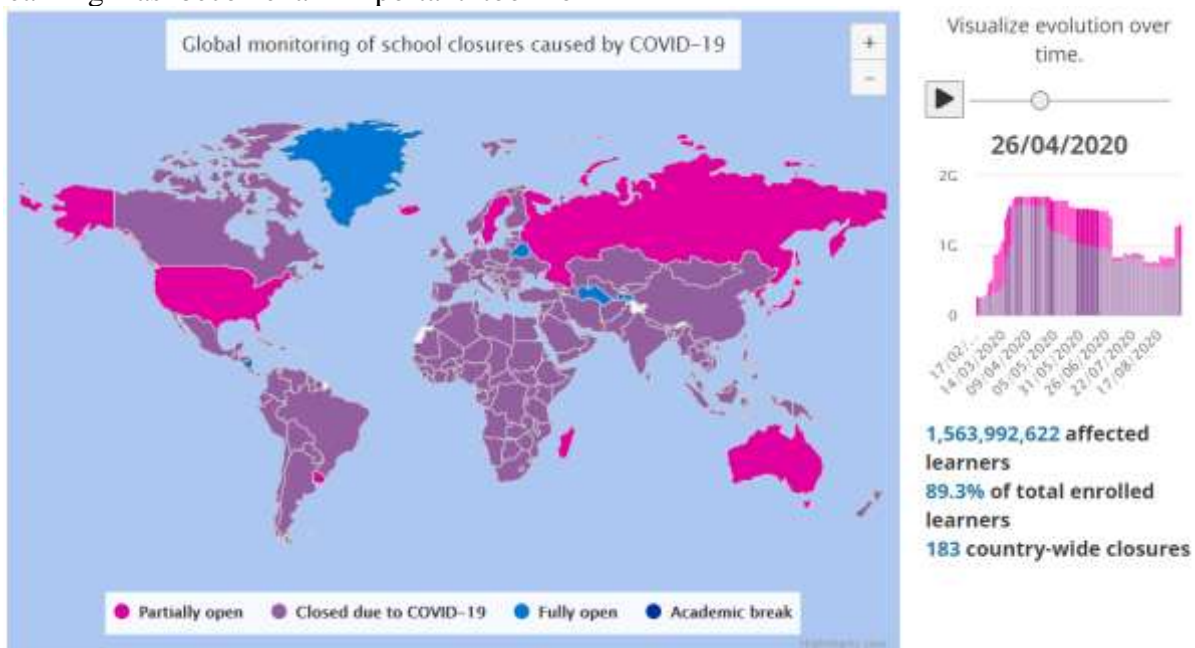
At an early stage, in attempts to define the concept, it was presented as any method of

using mobile devices to support learning [9]. The most influential researcher is Mike Sharples. There are also opinions in the literature according to which, in addition to the support for the learning component, learning through mobile devices also includes all the interactions that take place between teachers, pupils, students or other members who can take part in the learning process [10]. In a simplistic approach, learning through mobile devices can be defined as “the ability to access educational resources, tools, or other types of materials at any time, from any location, using a mobile device [11]. The notion was first used around the 2000s and emerged as an inherent need to develop technology and increase the popularity of mobile devices [12]. Over time, mobile learning has become an important tool for

education, preferred due to the flexible and personalized approach to learning.

### 3 Impact of the pandemic

When the pandemic spread in different countries, the governments started to close most of the working sectors and kept most of the people at home [13]. While the students were isolated at home, the educational institutions began to hold their courses online so the semester could go on. In case of those schools and universities that did not already have educational platforms for e-learning, teachers had to use various online communication applications such as Zoom, Skype, Teams, Facebook Rooms, WhatsApp, and many others to interact with their students [14].



**Fig. 1.** Global monitoring of school closures caused by COVID-19 at the end of April 2020 [4]

As we can see in figure 1, at the end of April 2020, 183 countries closed the schools and face to face courses because of the pandemic of COVID-19, where 1.56 billion of students, which means 89.3% of total enrolled learners, were affected by this and stayed home [15].

#### 3.1 Problems encountered in the pandemic

Schools and universities that were not prepared for this pandemic had major

problems communicating with and evaluating students. One reason for these problems would be that some teachers were not prepared to use online tools and had a hard time at first. The cause would be the elder teachers that never had to use technologies or the fact that they never participated in a specialized course in which they could learn to use the internet or a computer/mobile device [16].

Another big problem would be that some students did not have the means to connect online because they could not afford a device or did not have one at that time. Another problem they encountered was that neither parents, nor students knew how to use the devices they had to connect to the online classes. In some areas some problems were caused by the fact that there was no signal for the internet to be able to connect to the courses [16]. To all these problems, we might add the cases of the families with more than one child, where only one mobile/electronic device had to be shared by all the children with scholar age, eventually also with the parent working from home. The place of work also constituted a limitation for those pupils from the same families that had to share the same room during school hours.

Other problems encountered would have been with the existing communication applications when multiple users could not connect at once and sometimes a fee had to be paid if they wanted to have a normal online class. The schools and universities that did not have specific platforms for quizzes and sending homework had to improvise and had to evaluate the students in a different manner [17].

According to the European Commission in the last years the literacy rate and access to education for adults over 15 years old rose worldwide from 74% in 1990 to 84% in 2018 and from 45% to 64% in least developed countries. Worldwide, the youth literacy rate increased from 83% in 1985 to 91% in 2018, while the number of illiterate youths declined from 170 million to 115 million [18].

In least developed countries, literacy is lowest and higher among males than females. In the most recent years, young women accounted for 59% of the total illiterate youth population. According to the European Commission, globally, 123 million youth (aged 15–24) lack basic literacy skills – 61% of them young women [18].

Because of the high rates of literacy and the poor environment they live in, a big problem would be that some students did not have the means to connect to online courses. Some

students did not know how to use the devices to connect to the online courses and neither their families didn't know how to help them [19].

Due to the COVID-19 pandemic, college students had some problems, in addition to having to start attending online courses to complete the university semester, they were forced to leave the dormitories where they were staying, having no longer access in their campuses or to libraries to finish projects or final thesis. For most of them this meant also that they were forced to drop out their part-time jobs because they had nowhere to live [20].

Another issue that affected the college students was that most of the companies cancelled their summer internship programs due the pandemic of COVID-19. But some companies, as Google, accepted to have the summer internships online rather to cancel them completely [20].

OECD [21] presented eight important aspects related to the impact COVID-19 crisis on education: public financing of education, international student mobility, the loss of instructional time delivered in a school setting, measures to continue students' learning during school closure, teacher's preparedness to support digital learning, when and how to reopen schools, class size – a critical parameter for reopening of schools and vocational education during the COVID-19 lockdown.

#### **4 Methodology**

To understand how the e-learning and m-learning solutions helped the governments during the pandemic and the implementation impact on the educational area, we started by providing an overview for 16 countries worldwide and described the main means of communication used during the lockdown to provide access to education resources. At the end of the section we realized a comparison for the European countries whose situation was previously described, based on indicators available on Worldbank and European Data Portal website on October 2020 [22] [23].

In Argentina, an educational portal was created by the Ministry of Education aimed to provide digital resources for teachers, administrators, students, and families. They created a program called “Seguimos Educando” that began broadcasting educational content from the start of April. This program airs 14 hours content on television and 7 hours content on radio specially produced for students. The content is produced by teachers. For students without access to technology or connectivity the government delivered to their home’s notebooks packed with learning resources. Also, 55,000 netbooks and 22,000 tablets were distributed with pedagogical resources to ten provinces of Norte Grande. The devices can be used to access the digital platform Seguimos Educando, both offline and online, during COVID-19 [24].

In Austria, on the Ministry of Education web page many content offerings were prepared for students to access. They used different learning platforms as Moodle and LMS, as well as cloud solutions from Google and Microsoft. The content provided on the Eduthek platform, developed by the Ministry of Education, offers educational material for kindergarten and pupils of all school levels to practice at home and to deepen their knowledge. Also, from 18 March 2020 the public TV station started to offer special education program for students at all school levels [24].

Like other countries Bangladesh created a program called “My School at My Home” where students for grades six to ten could attend educational lessons on television. They were broadcasted every day from and uploaded online on the Bangladesh Television YouTube channel. The government has worked with UNICEF to help implement effective remote learning programs using TV, radio, mobile phone and Internet platforms. UNICEF supported parents and caregivers with information about the learning at home [24].

Brazil offered some educational content on YouTube on Futura Chanel. The states of Amazonas and Pará offered content on TV

and radio, and also published their educational content on YouTube [24].

In Bulgaria an e-learning system was launched on March 16 2020. Educational content is broadcasted daily on television and radio. Nearly 89% of students are enrolled in e-learning. The Ministry of Education and Science developed a National Electronic Library of Teachers (e-Content Repository), which publishes materials of pedagogical specialists for working in e-learning environments, that the students can access. All schools have set Microsoft Teams accounts for free for their students and teachers. Also, other programs are used as Office 365, Skype, and Blackboard [24].

On 9 February 2020, when the semester started in China, nearly 200 million primary and secondary school students were part of the largest simultaneous online learning exercise in human history. The initiative entitled “Ensuring learning undisrupted when classes are disrupted” was coordinated by the Ministry of Education with the help of school management agencies, online platforms and course providers, telecom providers and other stakeholders. They managed to boost their internet connectivity for online education, upgraded the bandwidth of major online education service platforms, provided online courses and resources, strengthened online security, and offered psycho-social support and courses to impart knowledge about the virus and protection against it [24].

In Croatia, the grades 1-4 of primary school students used the public television to learn. For grades 5-8 of primary school video lessons were filmed every day which were available on TV or online. Schools organized virtual classrooms on various platforms (Loomen, Microsoft Teams, Yammer) to communicate daily with their students. Telecommunications companies are also provided free Internet access (via SIM cards) to pupils of lower socio-economic status. The institutions of higher education organized themselves by having online classes. A helpdesk was set up by public agencies to provide help for users. For children with special needs and disabilities, the Ministry

made a recommendation to pedagogical staff at schools to design online classes adapted to such children [24].

The Czech Republic Ministry of Education, Youth and Sport created a website called "Distance Education" which supports schools and teachers with distance education. The website contains online educational tools and information. The Czech national TV broadcasted educational content for pupils [24].

In France an online portal called "Ma classe à la maison" (My class at home) provides access to educational content and learning opportunities [24].

The Ministry of Education of Georgia is developing an online learning platform with Microsoft at the general education level. In the meantime, a television channel provided access to online lessons and educational programs [24].

Italy government created a web site to support schools to activate different forms of distance learning during the closure period linked to the coronavirus emergency. The web site had various sections that the users can use to access platforms and tools made available by educational institutions free of charge thanks to specific protocols signed by the Ministry of Education [24].

The Korean government has invested USD \$250 million to address the impact of COVID-19 on education. This is about a 4% increase from the total education budget in 2020. The budget is being used for supporting online education platforms, zero-rating public education websites, expanding after school day-care services, purchasing necessary health equipment for teachers and students, etc. Students could access free online courses for all ages and also programs were broadcasted on television and radio [24].

Russia has a few online platforms like Russian online school, Yandex.textbook, Teach.ru and Yaklass that are available for teachers, pupils, and parents. Russian IT companies are also supporting the Russian education system. For example, Mail.ru provides access to its platform for online learning, Yandex provides video classes for schoolchildren in grades 5-

11, and GeekBrains gives free access to its programming courses. The Russian universities have transferred the educational process online. Universities are sharing their experience in the moving educational process online on the Scienpolicy Telegram channel [24].

In Libya a deal was struck with a local television that broadcasted lessons for middle and secondary schoolchildren [24].

Mongolia closed the schools since January 2020. The Ministry of Education broadcasted lessons on television since February 2020 for every grade and made those lessons available online on its own platform [24].

In Romania, after the courses were suspended, the Ministry of Education postponed the simulations for the National Assessment, the national Baccalaureate exam, but also of various practical tests or various competitions. The Ministry of Education has resorted to the use of online platforms, made available free of charge by several companies. In addition, the national television facilitated access to education for those children who cannot access online platforms. With the help of volunteer teachers (over 50 teachers) from March 16 2020, the first teaching-learning shows were broadcasted on television. Technology-assisted student support courses and access to the suite of educational applications were offered by the government under free license by Google and Microsoft [25].

The use of mobile solutions in this pandemic in the education system brings benefits among highly technologically developed countries and not only: they are customized methods, adaptable to user's needs, offer constant updates and access to information in real time. The mobile solutions can be considered learning and complementary methods but also independent, they support distance learning, stimulates interaction between users and reduces communication barriers, using communication channels preferred by pupils or students [11].

There are only a few indicators available now to describe the impact of the pandemic on the education and the readiness to implement

digital education. For the European countries for which we described the situation previously, we gathered the available data found on European Data Portal for COVID-19

[23] and Worldbank Website [22]. The main channel used for education purposes column was filled based on previous analysis.

**Table 1.** Digital education during COVID-19

Country	School Status (October 2020)	No. of students	Access to internet (%of population)	Have a quiet place to study (%of population)	Can use a computer for school (%of population)	Main channels used for education purposes
Austria	Open with limitations	1,708,540	87.5%	95.3%	94.7%	Online platforms, TV
Bulgaria	Open with limitations	1,224,400	64.8%	76.6%	86.5%	TV, Radio, National e-Library
Croatia	Open with limitations	2,068,763	75.3%	86.8%	90.2%	TV
Czech Republic	Open with limitations	787,188	80.7%	89.7%	94%	Website, TV
France	Open with limitations	15,462,340	82%	90.9%	87.6%	Online Portal
Italy	Open with limitations	10,876,792	74.4%	89.5%	88.9%	Website, online platforms
Romania	Open with limitations	3,483,465	70.7%	91.8%	86.2%	Online platforms, TV
Russia	Open with limitations	28,618,148	80.9%	85.7%	91.1%	Online platforms

Source: European Data Portal, UNICEF, Worldbank (2020)

## 5 Results

For almost all the countries worldwide, due to the partial or total lockdown occurred, solutions and modalities must be implemented to avoid, among others, the disruption of education. The presented countries used mainly the TV, internet, and online platforms to continue providing learning. The solutions differ from one country to another, based on technological development and infrastructure available. Many countries used the television as principal or additional method as it reaches a wide variety of persons. There is still many people without access to internet, personal computer or another electronic device, to support the online teaching. The online

platforms and m-solutions are also to be used at they might provide tailored courses and to reach exactly the target audience, education being a sensitive area and special attention should be paid to every student.

Countries and governments should be able to choose tailored electronic education methods based on the needs of the communities. Into this decade, technology integrated solutions should be provided to continue the development of electronic learning. Considering that there are a lot of domains that use already the online environment to continue their work during pandemic, without interruptions, based on their experience, a back-up solution for the

crisis should be developed, at least once the pandemic will end, when all the data will be known.

## 6 Conclusions

The shock of the COVID-19 pandemic on education has been unprecedented. Worldwide it blocked the objectives of the international education and set the clock back disproportionately for the poor and vulnerable students. And yet, the education community resisted and started the process to come back to normality.

It is expected for the students to suffer a setback, despite the widespread move to online teaching. The learning process will not be the same as if the schools would be open, although online learning has a lot of potential [26].

As we described in this paper, many countries tried to find solutions for the education system in this COVID-19 pandemic and they managed to share the educational content via television, radio, or internet, by using different platforms [24].

The pandemic has caught us unprepared, as there is no general method to opt for with maximum chances of success, regardless of the technology used. Now there are not sufficient educational resources developed, to be adapted to all ages or enough trained personnel.

The limitation of the study is that more information is needed from the countries affected by this pandemic because they are not enough available, in terms of reports or specific indicators analyzed, also a better view can be created on how this pandemic impacted the education system when the pandemic will end because then we will be able to analyze more information.

In conclusion, we can say that the existing mobile solutions and web solutions are currently having a strong impact in the education system, and they can change the future for education worldwide. Although initially considered an alternative to the traditional system of education, it proved to be one of the few solutions to continue the educational process, although there is a full

range of students that did not benefit from the online courses, mostly due to some infrastructural limitation.

As a future direction for this research will be a case study about the start of the scholar year. We'll be able to analyze the impact of m-learning and e-learning in the next period since the COVID-19 pandemic is not over and we'll see what these solutions bring to the conventional methods of learning.

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