# Analysis of the Consequences of Changes in Educational Technologies During the Covid-19 Pandemic and the Post-Pandemic Period

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Abstract: During the COVID-19 pandemic, digital technologies have become the primary means of learning, both during the outbreak and post-pandemic. In most countries around the world, human flow and circulation management procedures create a difficult situation for educational institutions. Digital education and innovative technologies now more than ever make a significant impact on many areas of socio-economic factors around the world. The article uses an analysis of articles in the Scopus database related to digital education in 2020 to explore the advantages and disad-vantages of remote education.

## 1 INTRODUCTION

Digital educational technologies became the primary means of learning during the COVID-19 outbreak for educational institutions and students. In the post-pandemic period, the importance of digital remote technologies has not only remained relevant, but has also gained new innovative qualities in educational processes. In most countries of the world the order of human flow management creates a difficult situation for educational institutions, the inability to effectively distribute the flow of students to continue face-to-face classes has brought the issue of interaction with students to a new level of complexity, requiring innovative solutions. Globally, a situation has emerged where educational institutions depend on the availability of the Internet and digital networks to effectively continue their educational programs and participate in learning activities. Therefore, countries with advanced internet infrastructure and high quality network distribution devices may respond better to the introduction of remote education during the pandemic outbreak. The concept of digital distance learning was practically tested during the COVID-19 outbreak. Many researchers believed that online and distance learning was possible with the existing infrastructure. The pandemic outbreak proves that the existing resources and infrastructure in most cases may not be enough for full-fledged digital education.

## 2 DIGITAL DIGITAL TRANSFORMATION OF EDUCATION DURING THE COVID-19 PANDEMIC AND IN THE POST-PANDEMIC PERIOD

After the outbreak of the Covid19 pandemic, in the post-pandemic period, education continues to be in the state of active digital transformation, which is one of the pressing topics for researchers of the present time. Researchers around the world are conducting investigations related to the digital transformation of education, and many international forums predict that the future of education depends on digital trans-formation and development, just like all other areas of daily life (Bozkurt and Sharma, 2020). In this context, digital education technologies research has generated significant interest from the research and

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education communities. Using a large database analysis to ensure adequate awareness of the impact of digitalization of education during the pandemic, documents related to digital education were selected for analysis to explore emerging topics to explain and discuss the merits and demerits of this phenomenon (Khan & Qureshi, 2020). Researchers investigating this problem describe both the achievements of remote education and the problems encountered during its implementation. The main achievement of the research in this area is the set of solutions, which should provide a useful overview of the means and methodologies of sustainable digital education after the Covid19 pandemic. The data for this study was obtained from Web of Science and Scopus databases.

Despite the fact that digital education is increasingly empowering in terms of the outstanding benefits of accessibility and reach for teaching and learning, cost and time savings, flexible location, travel savings and increased inclusivity in education, it was only when the Covid19 pandemic occurred globally that digital education has become fully applicable in the education system.

Considering the academic concerns related to the digital tool applied in the post-pandemic education, the authors have come to the following conclusions:

Firstly, digital communication platforms have proven to be a useful tool for educational institutions that have survived the Covid19 crisis, and even improving their performance because of it. Digital education has provided a platform for extension of collaboration between educators and learners and allowed to reach new achievements;

Secondly, digital education applied across all levels of the education system during the pandemic and in the post-COVID-19 period, offering a wide range of advantages leading to satisfaction of the stakeholders. Publication or conversation (text / image / poster) and video on the one hand, and virtual meeting for discussions on the other hand, taking full advantage of the emergent education-related technologies, focusing on the public information model;

Finally, the use of digital communication to guide, in-form, and support students successfully transitioned from face-to-face to online learning, through digital platforms, asynchronously or synchronously; In this case, video of virtual experiments or hands-on activities can help students to achieve the required performance.

These studies have shown that the integration of learning theories with digital technologies has changed the learners' thinking and ways of constructing knowledge. Many foreign studies mentioned online learning methodologies as an effective tool allowing to engage the students and support their satisfaction (Sá, MJ, Serpa, 2020).

In addition to teaching and learning, digital education brings together scholars around the world in various fields of studies. With the national borders of the countries worldwide closed and the number of people crossing borders limited, the development of digital education opens a new platform for global knowledge sharing around the world. An example of this is the virtual international conferences held at the universities in different countries, which creates a vast space for academic practitioners and students to exchange their re-search; nowadays, virtual knowledge sharing through online conferences has become a standard practice all over the world (Vasilieva and others, 2020).

In addition to the benefits of digital technology for education during the Covid-19 pandemic, reviews of distance education revealed some challenges. Educators face the challenge of readiness to use technology to connect with students and the complexities of online learning pedagogy when applying full-scale online teaching and learning mode during and after the pandemic (Boychenko and Platunina, 2021). Student performance during online learning assessments shows challenges, especially regarding medical, engineering, and sports education. Some universities failed to achieve adequate student performance during the pandemic in the beginning of the semester during the first wave of the pandemic. Solutions to improve the performance of distance education also require further discussion, for example, universities should restructure curriculum and methodologies and tools to test learners' knowledge, as well as provide appropriate setting allowing the proper functionality of the technical equipment for digital education (Boychenko, K. and others, 2021).

Education is highly correlated with innovation and con-tributes to socio-economic development. Digital innovation provides a new form of digital education in teaching and learning and transferring information and knowledge to the community during the pandemic education (Boychenko, K. and others, 2022).

Undoubtedly, digital education is a great environment for professors, teachers and students to exchange innovative ideas and create products to continue the advancement of digital innovation (Salutina, Platunina and. Vasileva, 2021). Based on the reviews of more than 1,500 articles related to digital innovation during the pandemic in the Scopus database in December 2020, it is concluded that the subject component level shows remarkable growth figures in social sciences (Knox, Boychenko, Platunina,2023) business management, computer science, and engineering and medicine (20.3%; 16.7%; 12.2%; 9.8%; 8.1%, respectively) (Salutina and others , 2021).

# 3 DIGITAL INNOVATION AND DIGITAL EDUCATION DURING A PANDEMIC

During the pandemic period, digital innovation had a significant impact on social change. Even though educators and students work from home using available digital equipment, due to the isolation policies applied worldwide to prevent an outbreak, new digital innovation products that help people to stay safe and to overcome challenges related to social isolation, while gaining new knowledge, has emerged (Platunina, Salutina and. Frank, 2023).

At the same time, higher education institutions are harnessing the potential of collaboration and collective intelligence to develop and implement more robust and sustainable entrepreneurial initiatives. In education, digital innovation is linked to the digital entrepreneurship ecosystem, emphasizing the integration perspectives. Reviews show that most studies mention that digital education links digital innovation and digital transition to the social and economic system such as business, health, medicine and engineering.

Also in social and health care institutions, the inventions of scientists related to the separation of human flows in institutions of different orientation have been applied (Boychenko, K. and others, 2019). The use of robotics, responsive and adaptive technologies, interactive architectural design, and innovative approaches in architecture allows to minimize the danger of overcrowding and reduce the potential time people spend in dangerous areas together allowing appropriate social distancing. Virtual assistants are aimed at helping people and optimizing the activities of institutions in the post-pandemic period as well.

Digital education has remarkable impact on many areas of social and economic life around the world, both during and after the pandemic. We used the analysis of the articles in the Scopus database related to digital education in 2020, the year of the Covid-19 outbreak worldwide. The results show that the reviews classified four major clusters for analysis and discussion listed below:

1) Rapid online learning involving short courses to acquire new skills and competencies required during the Covid19 pandemic;

2) Digital education during the pandemic and the new condition of obtaining new knowledge;

3) Digital education in the field of health contributing to the public health needs;

4) Digital education and the development of digital innovation during the Covid19 pandemic.

The authors of the article consider the following possible options for the development of the world educational systems in the period after the Covid19 pandemic to be the most probable in the near future:

1.Education will still retain the trend towards massification and internationalization, the future development will aim at expanding the scope of e-learning with maximum audience coverage. Advantages of this option include avoiding challenges related to objective restrictions on the travelling and movement of students and staff both within countries and abroad, as access to the educational product can be granted from anywhere with access from anywhere as long as the internet connection is available; universities will have the opportunity to save on the maintenance of the property and facilities, reducing the cost of non-core assets: sports facilities, catering, cultural centres, etc. This strategy will also allow to significantly reduce personnel costs, including teaching staff. In conditions of declining incomes and living standards of the population the universities using this strategy can offer more attractive financial conditions for education and attract more students by reducing the cost of education (Salutina, Platunina and Frank , 2023).

2.Universities will strive to preserve the existing forms of practice (utilising the so-called blended learning) with the prevalence of offline face-to-face programs. The advantages of this option are related to maintaining traditional forms of education, preferred by many students; universities get the opportunity to keep their students and attract new ones, as the opportunity to be in the chosen country of residence during the period of study creates a competitive advantage.

The two main options can be applied by different institutions in variable combinations. Also, differences in the applied variants are noted in different countries of the world.

# 4 CONCLUSIONS

We consider it necessary to note that the generalized experience of the leading world powers shows common shortcomings and problems identified during the analyzed period.

Based on the main analyzed parameters, we can conclude that the main problems today are: obtaining of new competencies; obtaining of knowledge in the new conditions; development and availability of digital innovations and the challenges of medical education in the new conditions (Salutina, Kuzovkova and Platunina, 2023).

Analysing the impact of the phenomena of the Covid19 pandemic on the education system, it is worth noting the special role of human potential, which has become very significant in choosing the trajectory of development in a critical situation. However, despite the severity of the consequences of a complete socio-economic lockdown in education, significant learning outcomes and education and research results were achieved, which provoked the growth of educational organizations' capabilities in the application of information and telecommunication technologies (Salutina, Kuzovkova, Platunina, 2023), improving their quality, expanding the nomenclature, developing a set of tools and, respectively, the functionality of educational content, modernization of training programs, as well as the introduction of a new order of training in the educational process.

It is expected that the results of the research presented in the article will benefit stakeholders studying and working in the field of digital, face-to-face, and remote education in the post-pandemic period.

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