

DYNAMICS AND EFFECTS OF COVID-19 IN EDUCATION PROCESS

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ABSTRACT— *The digital transformation and digitalization of education has been an important topic in the last decades, but before the Covid-19 crisis it was approached in a slow pace and carefully rather than insistently and on a global scale. Existing plans to expand and implement digitalization in education were ubiquitous and were present in a number of international, European and Bulgarian policy documents. They address the needs and importance to enhance and improve the efficiency of the digital education processes, including the digital skills of teachers and students. Digital transformation processes got accelerated in an ad-hoc manner, within a very short period of time, after the early months of 2020, when the Covid-19 pandemic started. As a result of this health crisis, the world started using more active and effective the existing digital communications and information technology products. People got quickly acquainted with a number of popular digital tools, used for education purposes, that were available but were not part of their work until 2020. Thus they avoided the risk of suspension and significant interruption of the global education process due to the massive closedown of schools. Although, facing a number of difficulties, the quality of education did not remain up to the level of face-to-face learning, both learners and teachers made great strides in the adoption of many digitalized products. This report examines some of the global and local developments and the effects of the Covid-19 crisis in education.*

Keywords: Covid-19, digital tools, digitalization, education

1. INTRODUCTUON

The digital transformation of modern society and its undertakings are of great importance for the continuing improvements in the lifestyle and wellbeing of the people of our planet. Modern technologies accelerate the dynamics of the expansion of all human activities, bringing more efficiency and convenience. The new world is predominantly digital - accessible, fast and for everybody. Education is a somewhat more conservative area of human activities, even that a number of digital transformations have occurred and continued to do so everywhere. The past two years have witnessed a huge leap forward in the field of digital transformation because the Covid-19 pandemic has left little time for universities, schools, teachers, students and pupils to think of the existing options. And there were only two of them - either to stop with the studies or quickly adopt and grasp most existing digital technologies to the everyday educational activities. The policymakers have already drafted plans to increase the efficiency of the education system in documents such as *A Europe fit for the digital age* (EU, 2018) and the *Digital Education Action Plan (2018-2020)* (European Commission, 2018). The latter was updated in 2020 with the *Digital Education Action Plan (2021-2027)* (European Commission, 2020). It recognizes the unprecedented impact of the global health crisis on the use of digital technologies for education and training and gives direction for the next steps. The Action plans show also opportunities, especially in terms of improved quality of the training process. Prospects are presented for wider implementation of new digital methods and pedagogies in training, and the creation of the

necessary infrastructure for sustainable remote learning is justified. The dynamics of change in plans has been not only on European level but also on national level, as the situation in most countries in the world, due to the health crisis that started in 2019 with the Covid-19 pandemic, was similar. This work presents the way and the pace of changes and transformations in the area of digitalization of education as part of the sudden leap in the digital transformation of the entire world, which occurred in the last two years. We also make a look in the near future, pointing out some of the modern technologies and approaches that will further improve and enhance the quality of the digitalized education.

2. THE DIGITALIZATION AND THE OUTBREAK

Broadly speaking, digital transformation and digitalization are application of digital tools and technologies in any sector of human activity. These include mobile and stationary digital tools (servers, computers, laptops, smartphones, etc.), digital communication (Internet and mobile networks), cloud technologies, Artificial Intelligence (AI), blockchain, Internet of Things (IoT), Big Data, Augmented Reality (AR) and Virtual Reality (VR), etc. The transformation itself involves a conversion of all kinds of interactions, communications, business processes, business activities and business models into digital ones. Thus the activities of any participation in the digital transformation organization, enterprise, institution or process will be carried out mainly or entirely by digital tools and technologies (Boyanov, 2021). During the last two decades, digitalization has penetrated in most spheres of human activity like production, economy, business, supply chain management, etc. The process also made all those endeavors global with significant impact for the entire world. In the area of education, there also have been some small steps in digitalization, in regard to topics and features like communications, exams and sharing the content of the teaching material - presented in Figure 1. The figure shows the changes for the last 20 years, during which time, the digital technologies have far more aggressively entered other areas of human activities, mentioned earlier. The most significant changes during these 20 years in education were substituting the paper materials with electronic files, making the vast amount of communication online and introducing electronic tests.

At the same time, one can point out that the Covid-19 outbreak caught the world not well prepared for a global health crisis in regard to the place of work (and education) activity. The humanity was at an advanced stage in the application of digital technologies. Products like personal computers, tablets, laptops were no luxury, and almost everybody had a smartphone. High speed and mobile Internet have deeply penetrated the developed countries and have been used by the majority of the population. Had the virus spread in the same way 15 years earlier, the lockdown in most countries would have brought much greater damage to societies and economies due to the lesser number of digital devices and Internet connectivity. One survey showed that on European level less than 25% of the education institutions lacked digital infrastructure and even less – 17% - support for digital technologies (EUA, 2020). Even today, the full implications of this pandemic cannot yet be reported, there is no argument that existing technologies and their relatively good level of penetration in businesses and households have greatly facilitated avoidance of greater economic damages and loss of human life. The world reacted in a very dynamic manner - internet traffic in the five months from the end of 2019 to May of 2020 grew by 60% and video conferencing traffic by around 120% (Soto-Acosta, 2020).

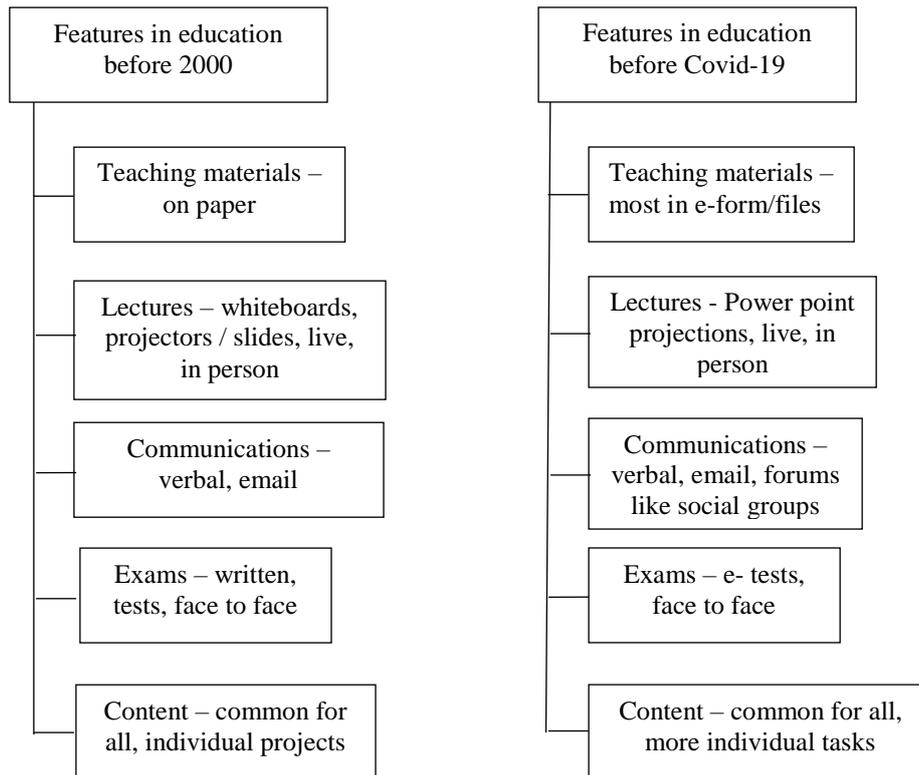


Figure 1. The state of some educational features during the period 2000-2019.

The rapid and unexpected emergence of the SARS-CoV-2 virus, as well as the lightning spread of information about it, has led to measures restricting the movement and assembly of people on a global scale. Only a fraction of people working as programmers and other IT professionals used remote working and communications before 2020. Even at the early months of the outbreak, about 47% of the workforce in the USA never worked remotely, but after Covid-19 – about 44% worked five or more days a week in that manner (Statista, 2020). This shows that many other professions (and not only in the IT sector) had the options to use digital technologies on a wider scale earlier but such transformation did not happen until 2020. The reason was simple - when humanity was faced with the dilemma of whether to stop going to work (or to school) or do it from their homes with digital technologies, both employers (teachers) and employees (students) chose the latter option. The workplace, and the learning space for a large number of professions and activities, ceased to be in the office, school and university, and moved to the home environment.

The pandemic hit very hard the education systems worldwide. The greatest impact has been on learners, both in universities and in primary and secondary schools. As a result, inequalities have increased and the existing crisis in education has intensified. Only in a few countries schools were not closed - educational places were closed in more than 150 countries in April 2020. In most part of the world, remote/online education continued until the end of the school year. The lack of internet connectivity and devices was glaringly apparent, disrupting the ability of at least a third of students to continue learning at a distance (UNESCO, 2020).

Within one year (from 2020 to 2021), the world managed to employ and further develop existing digital technologies and tools (software packets and services like Zoom, Teams and others existed before 2020) to enable people to work and study from anywhere. People somehow managed to find solutions for most of their activities. While Zoom reported 200 million meeting minutes in its first year of release, in April 2020 minutes with the same software were 300 million

in one day! And towards the end of 2021 there were 3.3 trillion minutes logged per year, making over 9 billion Zoom minutes per day (Backlinko, 2021).

Education has been regarded as a conservative area for a long time. Each major change there goes through strategic national programs and plans, committees, subcommittees, academic discussions (which can be endless) and public debates (also can be endless, as almost each member of society if not in education himself/herself has a close relative or friend being educated or trained). Even so, this complex network managed to get around the corner in a relatively short period of time. Some forms of e-learning existed before the Covid-19 pandemic, the most popular of which was the Massive Open Online Courses (MOOC). There have been more than 8500 courses with more than 120 million students in MOOC in 2019 (Class Central, 2019). However, at the time of lockdown, the digital approaches to teaching for the traditional educational organizations emerged as the only possible way for them to continue their activities. As a result, schools and universities digitally transformed their operations during the epidemic. This was in contrast to some prominent traditional department stores, that were already selling online but were unable to keep up with the timely delivery of orders during the epidemic, due to the lack of internal process transformation, required to meet the high demand (Soto-Acosta, 2020).

On a political level, the *Digital Education Action Plan (2021-2027)* aimed to follow the objective "...to support the sustainable and effective adaptation of the education and training systems of EU Member States to the digital age" (European Commission, 2020). In order to achieve long term high quality digital education, the Plan set two priority areas. The first was in improving the digital ecosystem with better equipment, infrastructure, planning, development, training, tools, platforms and improved learning content. This direction envisages five actions: 1) Strategic Dialogue with Member States; 2) Council Recommendation on blended learning approaches; 3) European Digital Education Content Framework; 4) Connectivity and digital equipment for education; 5) Digital transformation plans for education and training institutions, and 6) Artificial intelligence and data usage in education and training (ibid).

The second priority area was about improving digital skills and competence, including new technologies like AI, digital literacy and fighting disinformation. This direction envisages seven actions and establishing a Digital education hub. The actions are: 1) Common guidelines for teachers and educators; 2) Updating the European Digital Competence Framework; 3) European Digital Skills Certificate; 4) Improving the provision of digital skills in education and training; 5) Cross-national collection of data on student digital skills; 6) Digital Opportunity Traineeships, and 7) Women's participation in STEM (Science – Technology – Engineering – Mathematics) (ibid).

The document also presented the finding that "...on average less than 40% of educators across the EU felt ready to use digital technologies in teaching, with divergences between EU Member States", and "...almost 60% of respondents had not used distance and online learning before the crisis". Another point was that "...more than one third of 13-14 year olds ... in 2018 did not possess the most basic proficiency level in digital skills" (ibid). The situation was far from perfect but not hopeless.

Bulgaria also has an important policy document, which defines the vision and goals of the policy for digital transformation – the *Digital transformation of Bulgaria for the period 2020-2030* (Ministry of Transport and Communications, 2020). The document has been adopted at the end of 2020, taking into consideration the Covid-19 crisis. It proposed an adequate and modern policy to exploit all new trends for technological renewal of educational institutions. This in turn is to bring qualitative changes in the development of education. In this area, the priorities are related to building and maintaining high-speed and reliable communication connectivity, to offer digital educational services, digital management and remote interaction opportunities between the participants in the educational and scientific process.

Before 2020, most of the Bulgarian universities did use actively only few digital educational technologies and the majority of staff did not take advantage of existing tools for teaching and learning. The pandemic forced all teachers quickly to start using such technologies and improve their skills and competence in digitalization. Bulgarian universities and in particular the University of National and World Economy (UNWE) have accelerated their activities in adapting modern digital technologies and working in a new digital environment. UNWE was one of the pioneers in the country in a number of digital transformation steps. Such was the replacement of the process of filling marks from exam in a paper book (called *Main exam book*) with electronic protocols, digitally signed by each examiner. The former paper approach was not only time consuming for lecturers but also often fraught with errors. The second major step that the university undertook was the introduction of an electronic student card. It replaced the long time traditional student paper book, where exam results have been written on hand by lecturers. Before the Covid crisis UNWE also had online library access, online teaching resources (the Moodle system), online student services called *Web student*, that allowed student to check status of their exam, timetables and location of their lectures and labs as well as other services. The university had few online courses, online enrolling for the semester, online application for scholarship and online application for Erasmus.

3. THE CHANGE AND THE FUTURE

Covid-19 led to changes in the institutions and education process. A survey report carried in the European Higher Education Area (EHEA) (EUA, 2020) shows that almost all higher education institutions increased the use of virtual staff meetings, got new tools for communication and collaboration, employed new ways of teaching, made plans for enhancing the digitalization after the crisis, have improved or are on the way of upgrading their policies and processes on digitalization. The report also reveals plans for enhancing budgets for further digital transformations, increasing the understanding and the significance of cyber security, the need for tools for detection and prevention of plagiarism, better understanding the need of provision of open learning opportunities, better digital assessment, use of digital credentials, use of MOOCs and support of teaching staff.

Even that the fight with the virus is not over, the big crisis continued for a period of 12-18 months. At its beginning (April 2020), there were about 1.3 billion affected learners and more than 150 country-wide closures of schools, while at the end of 2021, there were only 10 million affected learners and only four country-wide closures (UNESCO, 2020). The number of MOOC also increased – there were more than 12 000 courses with more than 220 million learners at the end of 2021 – more than 84% increase in just two years compared to the 20-25% rise in previous years (Class Central, 2021).

Initially the students had mostly positive attitude towards on-line learning and teaching (ibid) but recently, students have expressed a lot of concerns, especially in regards to have more interactive activities during distance learning (Cadamuro *et al.*, 2021). The same study shows that teachers reported low levels of self-awareness and low levels of job satisfaction when engaged in remote teaching activities. Other sources showed lack of staff motivation as a significant problem for digital learning and teaching (more than 1/3rd) (EUA, 2020).

The University of National and World Economy also used the months of the Covid crises to push forward its digital transformation. In addition to the abovementioned services, it introduced online classrooms; the electronic student card was enhanced with more services, including a banking card; online exams (and mid-term exams); online enrolment in student hostels; online university entrance exam and even online enrolment at the university. The latter system is linked

with the Ministry of Interior for verification of candidate's personal ID.

3.1 Advantages of online education

The advantages of the digital/online education can be listed as:

1. Bigger flexibility regarding time and space – students can pay more attention to some courses and labs and less to other in line with their interests and abilities;
2. No commuting early in the morning or after a long day of activities at the university/school;
3. The learning institution can make savings in regard to physical locations, where courses are taught and also saving from utilities (water, gas, electricity) and staff;
4. Comfort for students – there are no front and back seats and often online communication with the lecturer is less difficult than such in face to face environment;
5. Comfort for teachers – teachers do not have to stand in front of a class all the time and some of them may feel more relaxed, which allows them to deliver the content in a calmer and stress-free way.

3.2 Disadvantages

There have been a number of disadvantages:

1. Lack of social interaction – for both students and teachers;
2. Not all students have the ability to study and concentrate in isolation without having the example of their colleagues;
3. Being part of a class/group increases the accountability and self-discipline, which can easily vanish with other more “attractive” activities at home;
4. Problems for lecturers during the creation of modern online courses and behavior during lectures – physical (live) environment is more dynamic and allows the teacher to draw attention of less focused students, or get into dialogue with those that are more interested, which is not so easy when he/she does not see the entire group/class;
5. Low levels of self-awareness and low levels of job satisfaction - lack of staff motivation;
6. Technical/communication/connection issues can easily disrupt the entire teaching process;
7. Too much time behind the screen for both lecturers and students was/is not good for health;
8. Problems with the digital tools for both students and lecturers (this will fade with time);

3.3 Certain conclusions and glance in the future

The Covid-19 crisis has demonstrated several things in the field of education:

- 1) The countries and their educational institutions must improve and enhance their ICT infrastructure, digital platforms, system and application software;
- 2) The educators must employ digital learning and teaching methods and start using better the existing tools for remote education and enhance their digital skills with more similar products;
- 3) The students must use more extensively digital tools like online learning courses and self-assessment and benchmarking tools. Students must also pay more attention to ethics and behavior in digital environment;
- 4) Educators and institutions should look at new emerging technologies like IoT, Big data, AI,

VR, AR and blockchain – they can not only change the technology of education but also enhance the educational content and improve security concerns;

- 5) The institutions have recovered at large and improved their readiness and ability to conduct online education, mixed/blended learning for crisis situations or for students with special demands;
- 6) More attention should be given to security – for both access, infrastructure and for application. Lack of such security can hamper and put the entire educational process in shambles.

The state of some educational features (as in Figure 1) after the Covid-19 crisis, and what is the expected in the foreseeable future are given in Figure 2.

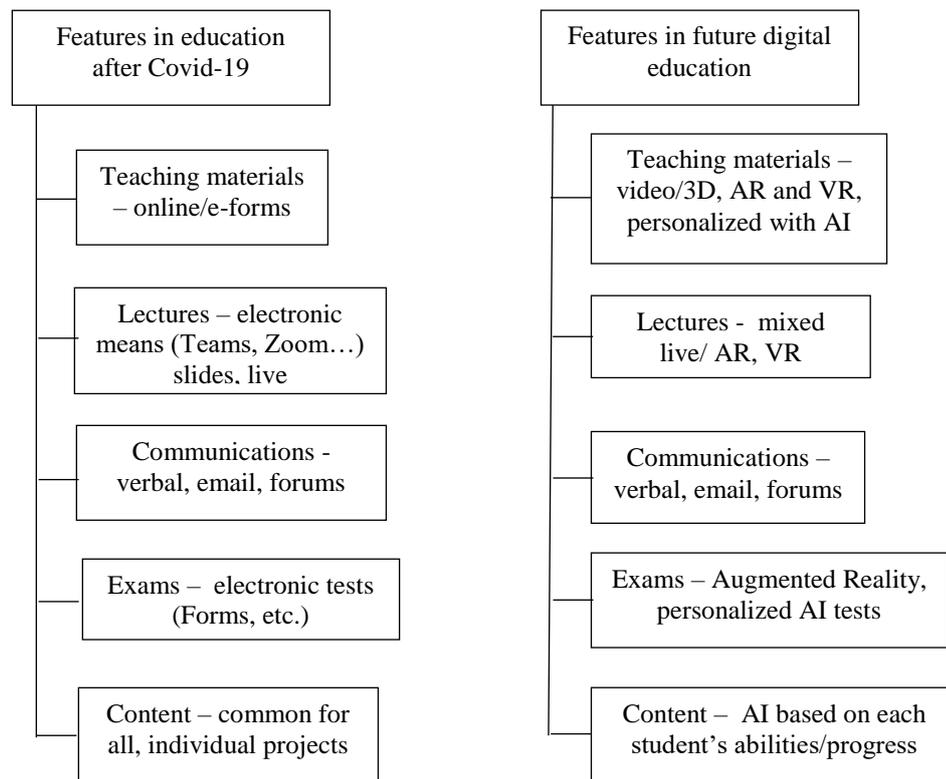


Figure 2. The state of some educational features in 2022 and in future.

4. CONCLUSIONS

The Covid-19 situation considerably transformed the state of affairs in the world. It affected all areas of human activities, including education. This work describes some aspects of the global digital transformation, including in the field of education before and after the outbreak of the Covid crisis. The dynamics of the use of information technology methods and digital tools due to the virus and their rapid adaptation to the new conditions of lockdown, remote working and learning were presented. The approaches taken in the aftermath of this crisis are given, including the update of policy documents in order to further accelerate the digitalization at global, European and national levels. The University of National and World Economy has been a leading institution in Bulgaria in terms of digital transformation and it has already adopted most of the aspects for successful digital and online education. We have also presented the pros and cons of online education, experience during those two years of it. It is evident that a blended approach has to be an option for each educational institution and any such must be ready to further enhance its

learning activities with new technologies like AI, AR, Big data, blockchain, IoT and VR. The education has a long way to go but it has overcome a significant step towards its modern digital identity.

5. ACKNOWLEDGEMENTS

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7. GLOSSARY

Artificial Intelligence – AI - the ability of a computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.

Augmented Reality – AR - an interactive experience of a real-world environment and computer-generated digital content like images, sound, text, etc.

Big Data - data that is so large, fast or complex that it's difficult or impossible to process using traditional methods – great variety, big volumes and more velocity.

Blockchain - a digital ledger of transactions/events that is duplicated and distributed across the entire network of computer systems, providing high level of security and non-repudiation of transactions/events.

Internet of Things – IoT – an arrangement of digital technologies for connection of objects (or groups of objects) that are embedded with sensors, processing ability, software, and other technologies. The connected object can exchange data with other devices and systems over the Internet or other communication or mobile networks.

Virtual Reality – VR - computer-generated environment with scenes and objects that appear to be real, causing the users feel they are submerged in the generated environment.