

DEVELOPMENT AND CHALLENGES OF DIGITAL EDUCATION IN POST-COVID PERIOD

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Abstract: This research paper analyzes the functioning of higher education systems during and in the post-COVID period with a particular focus on the increased application of information and communication technologies (ICT). The aim of the research was to examine the transformations in teaching methods and remote learning processes, identify the key challenges faced by educators and students, and analyze the competencies acquired by all participants in the educational process. Additionally, the paper explores attitudes toward the integration of ICT in higher education, highlighting both the positive and negative aspects of technology implementation in this context. Qualitative interviews with students and professors from the Faculty of Science and Mathematics and the Faculty of Law provided a deeper and more detailed insight into the changes brought about by the pandemic, emphasizing the adaptation of educational practices and their long-term sustainability.

Key words: higher education, information and communication technology, digital and generic competences, remote learning, post-COVID, educational challenges...

1. INTRODUCTION

At the beginning of 2020, significant changes took place across all educational institutions. Following the World Health Organization's declaration of COVID-19 as a deadly threat to humanity, the pandemic brought profound transformations to all aspects of daily life, including fundamental changes to educational systems at all levels. During the COVID-19 pandemic, teaching and learning environments rapidly and dramatically evolved for all stakeholders, including students, teachers, educational leaders, and pedagogues, driven by restrictive strategies adopted and implemented by governments worldwide. In this context, countries quickly transitioned to digital transformation in education and began actively encouraging the use of methods for online learning, teaching, and assessment far more than before the pandemic[1].

Digital transformation has changed society and the economy with an ever-deepening impact on everyday life. However, before the COVID-19 pandemic, its impact on education and learning was significantly limited. The pandemic revealed that an education and learning system suited to the digital age is essential. While COVID-19 highlighted the need for higher levels of digital skills in education and training, it also led to an increase in many existing challenges and inequalities between those who have access to digital technologies and those who do not, including individuals from vulnerable communities. The pandemic uncovered many challenges for education and systems related to the digital capacities of educational institutions, teacher training, and the general level of digital skills and competencies[2].

Education has traditionally been a highly social activity, deeply rooted in the personal interaction between teachers and students. However, nations quickly transitioned to digital education, actively promoting online learning, teaching, and assessment methods more than ever before the pandemic.

This sudden shift gave education a completely new dimension, surprising both students and academic and non-academic staff. Rapid adaptations were required from all parties, as traditional methods of teaching, assessment, and communication were overturned almost overnight. The primary aim of this paper is to explore the challenges of digital education in post-COVID period, with a particular focus on the increased use of information and communication technologies (ICT) among students. Additionally, the paper examines how students and higher education institutions responded to the new reality of learning and teaching, as well as how they adapted during the initial and later months of the pandemic.

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The findings will reveal the extent to which the everyday use of ICT either burdened or facilitated the work of students and educators. Furthermore, the study will investigate how prepared students were for a fully online experience, identifying the major challenges they faced during their studies and how the new situation impacted their daily lives. Special attention will be given to preserving and developing selected generic competencies that students are expected to acquire during their studies before entering the labor market.

2. ICT IN HIGHER EDUCATION

Higher education institutions and universities are striving to provide high-quality education while aiming to become attractive, innovative, and socially impactful institutions. The use of digital tools plays a crucial role in helping institutions achieve this goal, particularly by facilitating the improvement of teaching quality and educational outcomes.

Moreover, the adoption of Information and Communication Technologies (ICT) in education is often regarded as a means to significantly contribute to changes in educational systems. These contributions include better management of educational systems, preparing students for the information age, enhancing educational outcomes and students' skills, and equipping them for life in an information-driven society.

2.1. Methodology and the Method of Collecting Research Results

The study investigates the development of higher education and the increasing role of information and communication technologies (ICT) in the post-Covid period. The aim of the empirical research is to determine how students and professors perceive the significance of the role and application of ICT in higher education.

During the research, the following research questions were followed, serving as the framework for the semi-structured interviews conducted with the participants in this study:

- 1: How has the pandemic affected teaching in higher education?
- 2: Which elements of remote teaching would be useful to retain in the future?
- 3: How does ICT influence generic competencies?

Our sample of participants is divided into two groups: The first group consists of seven students in their final year of undergraduate academic programs at the Faculty of Sciences and Mathematics (students from the departments of Informatics, Biology, and Geography) and the Faculty of Law. Their age is estimated to be between 22 and 23 years, and they are currently in the process of completing their studies, meaning that after several months of live lectures and exercises, with strict adherence to preventive measures, they transitioned to online learning.

The second group consists of four professors who teach various natural sciences at the Faculty of Sciences and Mathematics.

2.1.1. Comparing the answers of professors and students to the first question

The most common form of online lectures was real-time video conferencing (59.4%), while the following forms were asynchronous: sending presentations to students (15.2%), video recordings (11.6%), and written communication via forums and chats (9.1%). The least common form was audio recording (4.7%), which is not surprising given the widespread availability of educational platforms and video conferencing systems (e.g., Moodle, Zoom, MS Teams, BigBlueButton), which have been widely accessible for some time [3]. This can be graphically represented as follows:

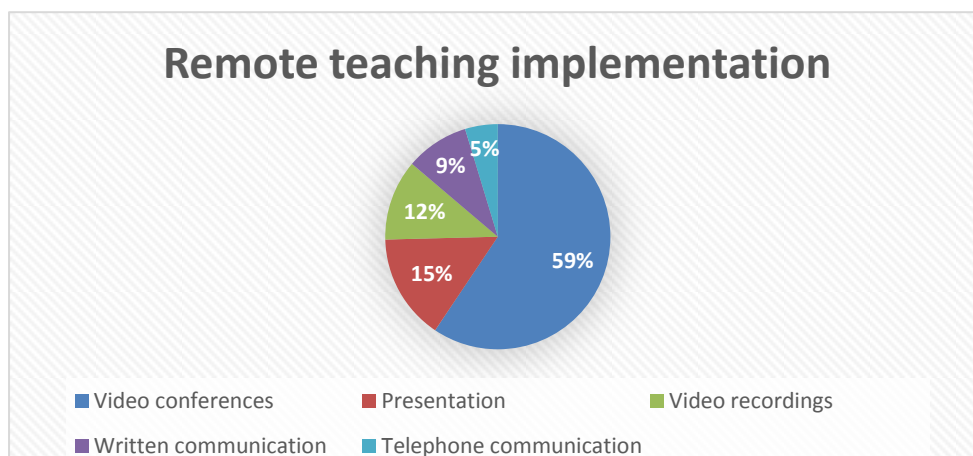


Figure 1 – Graphic presentation of remote teaching implementation

Students' responses regarding their impressions of online studying reveal significant differences in perspectives. Some interviewees stated that they hold a highly positive opinion of online studying for several reasons. The main reasons included reduced living and travel expenses, access to a vast amount of learning materials that greatly facilitated their work, more free time, and one student mentioned that through online studying, she significantly improved her digital literacy. Additionally, social isolation has encouraged some students to participate more actively, as ICT provides a certain degree of anonymity, meaning they don't need to step forward and expose themselves in front of others. [4]

Students with a negative opinion stated that their perspective stemmed from the inability to form and develop friendships and a sense of camaraderie among peers. They noted that the quality of lectures had significantly dropped, and they struggled to overcome certain problems (especially mathematical ones) without immediate help or in-person explanations from professors. Many of them also mentioned that their motivation and interest in studying significantly diminished because professors, after a few video calls (via platforms like Zoom and Google Meet), continued teaching through video presentations and Word documents uploaded to Google Classroom, which many students admitted they would only open when absolutely necessary.

Table 1 – Tabular presentation of the answers to the first question

Advantages	Disadvantages
Reduction of living and travel expenses	Reduced quality of lectures
Access to a wide range of learning materials	Difficulty in establishing friendships and a feeling of isolation from the community of peers
Excess free time	Insufficient preparedness of professors for the new situation
Higher digital literacy	Technical issues

Conversations with professors revealed that their experiences with remote education and the use of ICT during the COVID-19 pandemic and in post-COVID period varied as well. Before the pandemic, many professors rarely used online platforms in their work, or used them to a very limited extent. This led to what could be described as "resistance" or, more accurately, hesitance toward using such platforms. A commonly mentioned negative aspect of the pandemic in higher education was social distancing and isolation, which are almost unheard of in traditional classroom settings. This stems primarily from the fact that these aspects are critically important, especially in the social sciences. Based on the responses, it is also apparent that professors do not want ICT to take a leading role in higher education but rather to serve a supplementary function.

On the positive side, the integration of ICT into the higher education system is seen as the beginning of a new technological era, bringing new digital competencies that are essential not only in education but also in everyday life. Additionally, it heightened awareness of the ongoing importance of physical contact—not just for monitoring during assessments but also for fostering a better pedagogical approach, which still relies heavily on physical presence.

In general, professors with more years of experience observed both negative and positive impacts of online teaching. The negative impact was most evident in their desire to return to the classroom, where they could teach in the way they were most accustomed to and maintain social contact with their students. On the other hand, one professor noted significant differences among professors regarding online teaching. This, as said, mainly stems from individual characteristics, different lifestyles, and preferences. Some professors found online work more convenient and time-efficient, while others leaned more toward traditional methods of teaching.

2.1.2. Comparing the answers of professors and students to the second question

Each of the interviewed students believes that ICT has great potential for further implementation and adoption in higher education. It is a fact that automation is increasingly dominating the world, followed by digitalization. The students are aware of this and would like to retain some elements of remote learning that proved to be very beneficial during the pandemic. These include:

- hybrid teaching methods that offer greater flexibility and better use of time,
- recorded lectures,
- uploading materials to online platforms (in our case, Google Classroom),
- online consultations that enable faster and easier communication...

The professors responses align closely with those of the students. Three professors observed that ICT has been very useful for more efficient time management. In addition to faster and easier information flow and communication, it facilitated work organization, especially regarding online consultations and coordination. This eliminated the need to commute to the university daily during the week, resulting in significant time savings. Ultimately, it enabled educators to perform their pedagogical duties more effectively. Most professors would retain the concept of online consultations, as well as the online presentation of individual projects and the online defense of seminar papers.

2.1.3 Comparing the answers of professors and students to the third question

In this research, authors focused on three selected competencies within higher education :

- teamwork,
- working under stress,
- time management.

In terms of the selected generic competencies, the students mentioned various experiences. The first differences are already noticeable in relation to teamwork; reports were made on how ICT facilitated teamwork, and reports were also made stating that teamwork during the pandemic was more challenging, despite the use of ICT. Arguments in favor of remote teamwork primarily relate to speed, as it is not necessary to be physically present at the meeting location, and you can connect from anywhere via a mobile phone. Additional, it is simple to use, as this approach only requires knowledge of how certain platforms or applications function.

But we have students who, despite all the advantages ICT brings, still prefer personal contact. The most common responses (both positive and negative) from students can be presented in the following table:

Table 2 – Tabular presentation of the advantages and disadvantages of online teamwork

Advantages	Disadvantages
Faster and simpler organization	Lack of authentic, physical interaction
Easier exchange of ideas and quicker task distribution	In-person communication is easier for some of our respondents
Team members can be in constant contact regardless of geographical distance	Fear that some team members may not work as agreed

Professors evaluate teamwork as successful, which was reflected in the final grades of the students. This can be linked to the fact that students who were already more accustomed to using ICT before the pandemic were more flexible during the pandemic, felt more relaxed and confident when using ICT, and did not perceive the lack of personal contact as a major obstacle. The rules of teamwork itself did not change; the team assignments and instructions remained the same. The only change was the way students worked, which transitioned to online platforms, as well as the final presentation, which was also presented online.

When it comes to dealing with stress during and after the pandemic, the use of ICT caused the most stressful situations. Although ICT was used before the pandemic, the biggest difference was that during the pandemic, it became the only connection source, the only communication channel, and the only support on which (higher) education relied. Technical issues often arose, causing stress for the students. Adding to this, lower levels of motivation and concentration, more stressful situation during the studies could be expected.

According to the responses from our respondents, technical problems are still quite frequent, as they not only made it difficult to follow lectures but also complicated the assessment of knowledge remotely. To some extent, we can "blame" the human factor, as not everyone is highly technologically literate, while, on the other hand, some responsibility also lies on hardware and internet connection issues. For many users, this equipment is not the latest, leading to various disruptions and operational issues.

Apart from technical problems, the biggest sources of stress were:

- The use of new technologies for e-learning;
- Spending too much time in front of screens and in the same space;
- Poor time management;
- Uncertainty about new technologies and how the knowledge acquired through them would perform in exams;

The professors noticed very significant differences in student behavior, which can be attributed to changed life circumstances (closing of student dormitories, restrictions on movement within the community, resulting in a lack of social interaction) as well as a noticeable decline in motivation to work. Many life circumstances during that period prevented students from reaching their intellectual potential.

When it comes to time management, we observe divided opinions, both positive and negative, which can be separated into several aspects.

The first positive aspect mentioned is ICT, which significantly contributed to more efficient time management, as education took place from home, eliminating the need for additional time spent commuting to the university. All that was required was for students to sit at their computers and listen to the lectures.

However, two students point out that precisely because remote studies requires more work, resulting in greater time consumption. We must also mention the fact that during the pandemic

students were in their home environments, outside the academic setting, which could have further fueled resistance to work. The day became monotonous, with lectures following one another, and there was no clear distinction between free time and work time, which led to a noticeable degree of procrastination.

And the responses from professors vary. Three professors observe that ICT is very useful for more efficient time management in addition to faster and simpler flow of information and communication. There is no need to go to the university every day during the week, which allowed for time savings. However, one professor believes that ICT had a negative impact on time efficiency. She hopes that such an experience will not be repeated and that ICT will remain only as a supplementary element in teaching. She considers the use of ICT to be more exhausting, especially when household responsibilities, such as caring for the family, are added.

3. CONCLUSION

While students recognize the potential of a hybrid teaching model, where online and traditional education would be combined, professors generally prefer the classical approach to education. Many professors still emphasize the importance of physical interaction, believing that no digital technology can replace authentic contact between the instructor and students. This is especially true among older professors, who are less inclined to embrace digital innovations compared to their younger colleagues.

Differences have also been observed in the perception of teamwork, stress, and time management. Professors are mostly satisfied with the organization of teamwork, while students feel that ICT speeds up the process of coordination but still prefer the traditional approach to group work. On the other hand, the use of ICT has increased stress for students due to technical issues and the larger volume of material for independent study. Although professors report better time organization, students feel that they spend more time studying than before the pandemic.

In conclusion, while the pandemic has brought new solutions to education, it has also highlighted the necessity of thoughtful integration of technology into the educational process. Instructors' beliefs about the role of ICT are crucial for its successful application in teaching. This paper can serve as a foundation for future research on this topic, including a deeper analysis of the specific aspects of the impact and further development and application of ICT in higher education.

4. REFERENCES

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