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# Digitalization of Education: Analysis of Engagement and Socio-Demographic Features of Online Learning Participants

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**Abstract**

The emergency caused by the COVID-19 pandemic required instructors and students to switch to distance learning. Although higher education institutions had used digital technologies way before the COVID-19 pandemic, necessity caused by long–term lockdowns showed that digitalization became a part of teaching and learning process. Higher education professors took advantage of digital technology to deliver their educational services with no physical contact between instructors and students. Many of them transferred from traditional and blended pedagogy to fully virtual learning and distant course delivery. The purpose is to consider educational environment rapid transformation, but also to analyze shortcomings of completely digital learning and the impact it has on students and instructors. To understand how they coped with the transition to learning in digital format, we studied how they feel about it. Using the questionnaire, we found two different groups of people in education: the first was more interested in digitalization and successfully coped with the tasks of online learning, and the second scored lower in both of these areas. When compared in terms of their socio-demographic characteristics, as well as assessing the relationship between each socio-demographic marker and engagement in coping, it was found that instructors and students did better with digitalization and online learning if they had had previous experience in blended education. The conducted research was based on the methodology of data collection and analysis, gives a broad overview of how technological innovations overcome limited space and time in students education. Diversified educational resources are created by digital technologies implementation in education various aspects and spheres. The article is concluded with a discussion of the problems that arise and ways and methods of their solution. Distance learning has both advantages and disadvantages, but it is definitely here to stay.

**Keywords:** COVID-19, distance learning, digitalization, online learning, author's copyright courses.

## 1. Introduction

In spring of 2020, the COVID-19 pandemic influenced the education system disrupting the learning of more than 80 % of students worldwide and upending educators' lives. As higher education institutions tried to provide continuity of learning, instructors and students were forced to appeal to distance learning with no time to get ready for it. To understand how they coped with this transition, we focused on two key issues in our research: the participation of instructors in

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distance learning and students' coping strategies with the forced digitalization of educational material and distance learning in general. Although it was stated that the transition to online learning went well under the circumstances of the emergency, most of the respondents faced obstacles, such as insufficiently developed digital teaching materials, long adaptation to the distance learning model, insufficiently developed infrastructure, psychological and pedagogical factors of online learning (stress due to self-isolation, maladaptation, inability to organize personal and study time, etc.), personal and interpersonal contexts of educational interaction, including student performance assessment and final certification. In addition, it is necessary to mention the insufficiency of using the available technological tools and various training modes. Digitalization is a transition from the real to the virtual, from the physical to the digital space, that is, the introduction of digital technologies into various aspects of society such as the economy, education, public administration and others. Digitization in the field of education can include various multimedia and multimodal modes such as graphics, audio texts, video and animation (Makarova, 2018).

Four aspects of digitalization are usually discussed: (1) the use of the latest technologies, (2) the role of the teacher in the presentation of educational material, (3) the approach to the educational process and the final product on the part of students, and (4) the involvement of the target audience in the learning process (Camilleri, 2021). Digitalization is more than just another "fashionable topic" that will pass, the "eternal values" of education as the most stable social institution cannot remain the same. The modern education system is changing under the influence of changes in society caused not only by global crises, but also by the development of society in general and industrial revolutions in particular.

Some higher education institutions were able to transfer from existing traditional and blended approaches to fully virtual and remote teaching. However, such an abrupt transition often led to various technical and psychological problems for teachers and students. To conduct online classes, an Internet connection was required, as well as familiarity with the learning management systems of their universities, such as *Moodle, Blackboard, Zoom* and others. To get around these difficulties, many teachers chose to record their lectures on video, so as not to depend on the vicissitudes of the Internet connection, and make them publicly available. As an alternative to such recorded lectures, teachers communicated with students through virtual meetings, real-time video conferences, during which they could answer questions and provide clarifications if the lecture material was not fully understood. This synchronous interactive communication helped improve the learning experience of the students. Both parties needed training, facilitating or guiding the session to familiarize themselves with e-learning resources, as well as gaining experience in delivering online classes and using digital resources. Although the majority of teachers and students considered the turn to distance learning to be successful in terms of progress, some at the same time recognized a certain degree of complexity of this learning mode with a low level of preparation of teachers and students (in 75 % and 62 % respectively) (Zaccoletti et al., 2020).

At the same time, students noted that small groups and close contact with teachers are exactly what the majority takes into account when choosing a university for further education and mastering professional competencies. With online learning or digital presentation of educational material, this close contact is not possible. Instructors who delivered their lectures in real time mode evaluated online learning higher than those who pre-recorded their teaching materials or used them in asynchronous mode of delivery (any online content such as articles, case studies, videos on the topic of study, etc.). Two-thirds of faculty members reported disconnected from their audience and found it difficult to teach in synchronous mode, while most of the students figured out that they had lost touch with the student community and said they needed more time and effort to complete their coursework and homework in conditions where it is impossible to consult a teacher or classmates. During lockdowns and online teaching and learning, four strategies have proven to be effective in enabling distance learning. They included online vocational training, video conferences, webinars and communication between participants in the educational process by mail or via SMS (Baloran, 2020).

The study also took into account the age range of instructors, their teaching experience, academic degree and title, subjects taught, experience with failure, individual perception, cognitive abilities, as well as previous distance learning experience, such as blended courses, conducting webinars or receiving additional education online. The majority of instructors reported that they simply transferred their courses to a "synchronous" online real-time modality (58 %), while the rest preferred an "asynchronous" modality that was characterized by a less targeted impact on students,

these are methods such as sending educational materials to the mail and/or uploading pre-recorded content to the electronic information and educational environment of the university. The psychological overload of teachers was due to overcoming the consequences of the transition to emergency distance learning. Teachers were forced to urgently switch to online learning mode; there was no time to master digital literacy, as well as digital learning materials. Videoconferencing proved to be the most suitable alternative to classroom lectures and classes (Maher, 2020) as it allowed instructors to interact with students both in large groups and in small groups. The use of the *Zoom* platform allowed students to interact and work together in practical sessions.

The study also looked at factors that could potentially influence stakeholder behavior patterns. University instructors' adaptation to new teaching reality influenced their understanding of how students managed to cope with the new learning modes, balancing between acceptance and avoidance coping strategies and adjusting to positive and negative outcomes of forced distance learning psychological situation. In terms of the level of involvement of teachers in the online learning mode, their activities are associated not only with conducting online classes, but also with modifying the curriculum, overcoming technical difficulties (technical issues in the process of conducting online classes and digital competences in getting their teaching materials ready for performance in class), changes in the assessment scheme, as well as with the attitude of students and their own attitude towards online learning in general and the digitalization of the educational process in particular. As a result, a cluster analysis was conducted to better understand individual components roles and socio-demographic variables in overcoming the emergency transition by teachers and students to distance learning.

The results of the survey gave some idea of how to cope with the situation when both teachers and students are isolated from society, but continue to actively participate in the public and academic life of the university. Much depends on the individual characteristics of the teacher, on the specific factors that affect the well-being of teachers and the adaptation of students to a new form of distance learning, and the relationship between these factors. For example, many have pointed to the importance of maintaining the effectiveness of the learning process along with the synergy between work and personal life (Makarova et al., 2022). Our online survey was designed to explore what circumstances, behaviors, attitudes and psychological characteristics made it easier to accept the new reality, what difficulties the respondents faced, and what helped them to overcome them. Of great importance was the mode (real time or asynchronous) of the classes, as well as the differences between them from the point of view of teachers and students.

## 2. Materials and methods

Data collection was carried out using an oral survey and a special questionnaire created on a software platform for conducting surveys (in order to cover a larger number of respondents in different universities in the South of Russia). Eligibility for the survey was a shift from conventional face-to-face learning to online learning in response to the threat of the COVID-19 epidemic, as opposed to the planned and designed online learning that also existed prior to the outbreak. The result of the survey is also the desire to continue to work and study online, regardless of the need. The survey resulted in a report summarizing the opinions of teachers on the transition to distance learning, identifying significant differences in opinion about the productivity and effectiveness of this type of learning, the role of previous online learning experience and its impact on teacher adaptation and access to resources. The survey concluded that universities that previously conducted online classes had minimal problems when working in the new conditions; online tools and online conditions did not greatly affect the quality of the learning process.

In the studied context, the following demographic factors played a decisive role: age (pre-retirement age teachers could not quickly master the computer and the new online learning functions for them). In addition, they had problems with feedback, so most of these teachers chose the asynchronous presentation of educational material and receiving feedback from students in the form of written papers sent to the teacher's personal email or to the department's corporate mail. Although there is a significant gender disparity in our sample, dominated by women, the results show that gender did not play a significant role in the process of engaging in online work. Women teachers were also actively involved in the development of a new virtual reality for them compared to their male counterparts, attended master classes and webinars for more successful development and effective use in the educational process. There were no significant differences between gender groups in terms of solving technological problems. Work experience and previous experience of

online learning or teaching proved to be important for a smooth and quick adaptation to new circumstances. As expected, teachers who had experience in distance learning were significantly more involved in the work and also coped better with the difficulties in the classroom than those who switched to distance learning without having experience in this mode of work. From the point of view of the mode of conducting online classes, teachers who conducted their classes in real time were significantly more involved in learning compared to those who used asynchronous modes of presenting educational material (video-recorded lectures and video lessons). Interestingly, synchronous teachers also reported significantly less difficulty in using new technologies in class and withholding technical support during such classes. The digital era requires not only new digital competencies of teachers and students, but also a different approach to organizing learning itself. Based on the results of an expert assessment of teachers from three universities, we identified seven tasks for the digitalization of education that need to be addressed now in order to stay in the trend, and all of them should be addressed simultaneously:

1. Creation of information platforms for the use of digital educational and methodological materials.
2. Creation, testing and application of digital educational materials.
3. Refusal of paper information carriers, transition to innovative digital educational materials.
4. Development of applications that provide equal and free access to databases for all students, as well as the flexibility of learning and digital equality.
5. Development of a system of universal assessment of students' knowledge and skills, creation of new assessment tools.
6. Creation of a unified digital system of an educational institution.
7. Improving the skills and digital competencies of teachers in the technical sphere (Gáliková Tolnaiová, 2020; Gáliková Tolnaiová, 2021; Gordeeva et al., 2021).

In the transition to digital teaching methods, it was not clear which circumstances, behaviors, attitudes, or psychological characteristics were most important for teachers to successfully manage this transition. Therefore, in addition to socio-demographic information (age, gender, social status, level of education), the questions concerned personal and professional experience, knowledge of digital technologies, the type of educational institution represented, attitudes towards distance learning (synchronous and asynchronous), physical and mental health, as well as personal characteristics – factors considered important for adapting to the difficult conditions of a new situation. It was necessary to understand how teachers have adapted their traditional academic courses to distance learning and digital educational technologies. To study digital competence of both students and instructors, the questionnaire "Digital Competence Index" by G.U. Soldatova, T.A. Nestik, E.I. Rasskazova was used (Soldatova et al., 2017; Soldatova, Rasskazova, 2018).

## 3. Discussion

Traditional or blended education limits students and instructors to the designated auditorium at the designated time. The process of teaching and learning consisted mostly in sharing information, discussions, and arguments, thus giving birth to new ideas, gaining knowledge and contributing to science development. Before printed books appeared instructors and university professors had been the major resource of knowledge and ideas. Students met their teachers in somebody's house, spent some time together sharing information and solving problems. Later in the history of education, the first official places for teaching, called universities, appeared in different countries. Students and faculty met in classrooms; however, these were not the only place for learning. Libraries appeared in universities providing greater access to knowledge and acting as a hub for acquisition and exchange of knowledge. Most of teaching and learning occurred in specially equipped rooms where students and their instructors met. In the 21st century, things took a different turn as education is transferred from traditional and blended mode of teaching to distance and online modes of teaching and learning (Camilleri, 2019).

Digital education as we know it today began to take shape around the technological advances of the day and allowed greater flexibility in teaching to a wider audience. While some academic subjects are more suitable for formal academic education and require direct interaction between teachers and students, others, such as technical or scientific research, vocational training and professional development programs, require more independent work of the student and can be transferred to the online space. Technology, although advancing rapidly, is still unable to replace

the teacher in terms of the simulation of real-world experience and hands-on activities. From traditional to blended education, then to digital technologies introduction, distant learning is undergoing several levels of transformation; during the COVID-19 pandemic universities and other educational institutions offered numerous virtual courses online (Jelinska, Paradowski, 2021; Luckin et al., 2012).

Just like distance learning, these virtual courses transcend the barriers of place and time having advantages over regular distance learning due to the use of a digital environment and the digitalization of educational material. From a technical point of view, it was difficult at first to switch to distance learning for both teachers and students, as the emergency mode of distance learning was introduced due to the pandemic, although many universities have organized a help desk in case of failures and/or to solve technical problems. However, teachers occurred in a situation where they were not psychologically ready to use the digital environment for their classes, and there were also no teaching materials that could be used for online classes.

In addition, many teachers did not have their own digital resources to provide their subjects. Digital resources that teachers can find in the Internet are temporary in nature; they can disappear from the site at any time without a trace or an opportunity to be restored. That is why educators do not rely on the Internet resources or teaching materials created by others and set the stage for designing and developing their own digital resources and teaching materials. Students, in turn, experienced psychological difficulties due to isolation, which could unbalance them, or because of their lack of self-discipline. Senior students with more developed self-regulation strategies were better able to control their learning and allocate their time than students who had just started studying and had no experience of self-study and self-preparation at the beginning of the pandemic (Ayanyan, Martsinkovskaya, 2016; Zhai, Du, 2020).

The education and the way we teach and learn have rapidly changed. Student teaching has been transformed through the Internet in the form of online learning as an alternative approach to education. Now online education is changing from temporary approach in emergency situation into a permanent crucial factor of future successful life. Many researches consider problems that students have while getting education online; especially popular are studies that compare demographics of education process participants (Yu, 2021; Luic, 2022). Unlike many other researches, we have considered opinions of all the participants of education in our study (teachers as well as students), analyzed problems that both sides have experienced during the transition period and also outlined perspectives for the future.

Generated with the help of computer graphics, animation, Internet research and programming, digitalization is a product of not only information, but also teaching technologies. Modern ways of constructing a digital teaching and learning environment allow to register the position of a learner in it, which opens up new research for experimental capabilities and equips it with methods that have a number of advantages over traditional teaching instruments. Digitalization adds validity, flexibility, learners' polymodal stimulation and full involvement in teaching and learning process. Although digitalization was given an incredible boost during COVID-19 pandemic lockdowns, home science pays unjustifiably little attention not only to specific applications of new technologies, but also to problems related to its theoretical and methodological aspects (Andryuhina et al., 2020; Batrakova et al., 2021; Gáliková Tolnaiová, 2020; Gáliková Tolnaiová, 2021; Kopyrin, 2018; Polupan, 2018).

Digitalization was studied from social, philosophical, psychological, technical and other perspectives, many research works were published during the pandemic period in Europe and the Americas (Castaneda, Selwyn, 2018; Feenberg, 2017; Kimmons, Rosenberg, 2022; MacKay, 2019; Niedlich et al., 2021). On the one hand, pandemic COVID-19 actively stimulated incorporation and development of digital technologies into university activities. On the other hand, it revealed a number of limitations and factors that have a significant impact on digitalization processes not only at the level of an individual educational institution, but also on the education system in general. They influence public attitudes to the transition to digital teaching and learning instruments and in many boards determine the change in interaction between different structural elements of the system (Michela et al., 2022 ). Besides, there are new trends in digital assessment and evaluation of educational results, new digital tools of assessment that teachers should use now and in the future (Collison, 2021; von Davier et al., 2021; LaFlair et al., 2022; Langenfeld et al., 2022).

Three years ago there were just a few online courses in distant education, several digital tools were available for students and teachers, but the Covid-19 pandemic gave the boost to digital

education, 2020 marked a paradigm shift towards EdTech and the trend has strengthened in 2022. Teachers and students have realized that traditional offline teaching and learning haven't built the capability to provide the support needed in these hyper-competitive times. So many researches consider up-to-date teachers' competences needed for today's educational process (Ahadi et al., 2021). There is a certain digital competences framework needed for students in order to be successful not only in learning, but in their future professional career (Byundyugova et al., 2022; Egorova, 2022; Tzafilkou et al., 2022). Also, new methods of digital competence development have been proposed (Kosova, Redkokosh, 2022).

## 4. Results

The sample consisted of 328 students aged from 17 to 21 from three different educational institutions: Southern Federal University (Taganrog and Rostov-on-Don), Taganrog Institute of Management and Economics (Taganrog), Don State Technical University (Rostov-on-Don). Respondents were mostly freshmen and sophomores, 45 males and 78 females and 67 University instructors. Demographic components provide a wide coverage of the quantitative and qualitative composition of universities. Also, a questionnaire was offered both to students and instructors to figure out the strengths and drawbacks of online teaching and learning and competences of all the participants of online education. The results of the research are presented in the tables below.

**Table 1.** Various digital resources application in Russian universities (assessment by teachers and students)

| Resources | Instructors' assessment | | Reliability of differences (φ*; P) | Students' assessment | | Reliability of differences (φ*; P) |
|---|---|---|---|---|---|---|
| | 2021 | 2022 | | 2021 | 2022 | |
| University platform | 50 % | 53 % | 0,35; P>0,05 | 75 % | 90 % | 3,18; P<0,05 |
| Zoom | 69 % | 75 % | 0,77; P>0,05 | 75 % | 85 % | 2,05; P<0,05 |
| Moodle | 50 % | 55 % | 0,69; P>0,05 | 67 % | 69 % | 0,27; P>0,05 |
| Skype | 42 % | 40 % | 0,18; P>0,05 | 35 % | 33 % | 0,4; P>0,05 |
| MS Teams | 21 % | 23 % | 0,21; P>0,05 | 44 % | 48 % | 0,63; P>0,05 |
| Discord | 19 % | 21 % | 0,38; P>0,05 | 22 % | 24 % | 0,45; P>0,05 |
| E-mail | 94 % | 96 % | 0,84; P>0,05 | 87 % | 89 % | 0,58; P>0,05 |

Table 1 shows that during 2021-2022 there were certain changes in resources aimed at organization of teaching and learning. The percentage of *Moodle* use as learning management system grew, which integrated with the university platform created universities' digitalized environment. It also shows growing availability of open resources for organizing conferences, group meetings and online classes. As it can be seen *Zoom* maintained its position as the most convenient and accessible platform leaving behind *MS Teams* and *Discord*. E-mail keeps its positions as the most frequently used resource to exchange information, send messages and communicate.

Calculation of Student's t-test when comparing relative values is shown in Table 1.

Differences are statistically significant among students of the University platform and *Zoom,* among teachers differences are statistically insignificant.

**Table 2.** Comparing instructors' digital competences during different periods of online teaching

| Instructors' digital competences | 2021 | 2022 | Reliability of differences (φ*; P) |
|---|---|---|---|
| Most teachers used modern digital technologies for effective teaching | 35 % | 44 % | 1,24; P>0,05 |
| Most teachers used digital teaching materials from open access resources | 56 % | 67 % | 1,24; P>0,05 |

| Instructors' digital competences | 2021 | 2022 | Reliability of differences (φ*; P) |
|---|---|---|---|
| Most teachers used different platform to arrange their classes | 42 % | 78 % | 4,54; P<0,05 |
| Most teachers used their own digital resources for effective teaching | 39 % | 86 % | 6,27; P<0,05 |
| Most teachers had digital competences for organization of effective teaching | 45 % | 89 % | 6,28; P<0,05 |

Table 2 shows that teachers significantly increased their knowledge and skills in digital technology application for the period of temporary restrictions and online education; improved digital competences indicate the dynamics of digital content development, self-assessment of teachers' progress in creating own online courses and other teaching materials. Positive dynamics and attitudes to changes are shown in Figure 1.

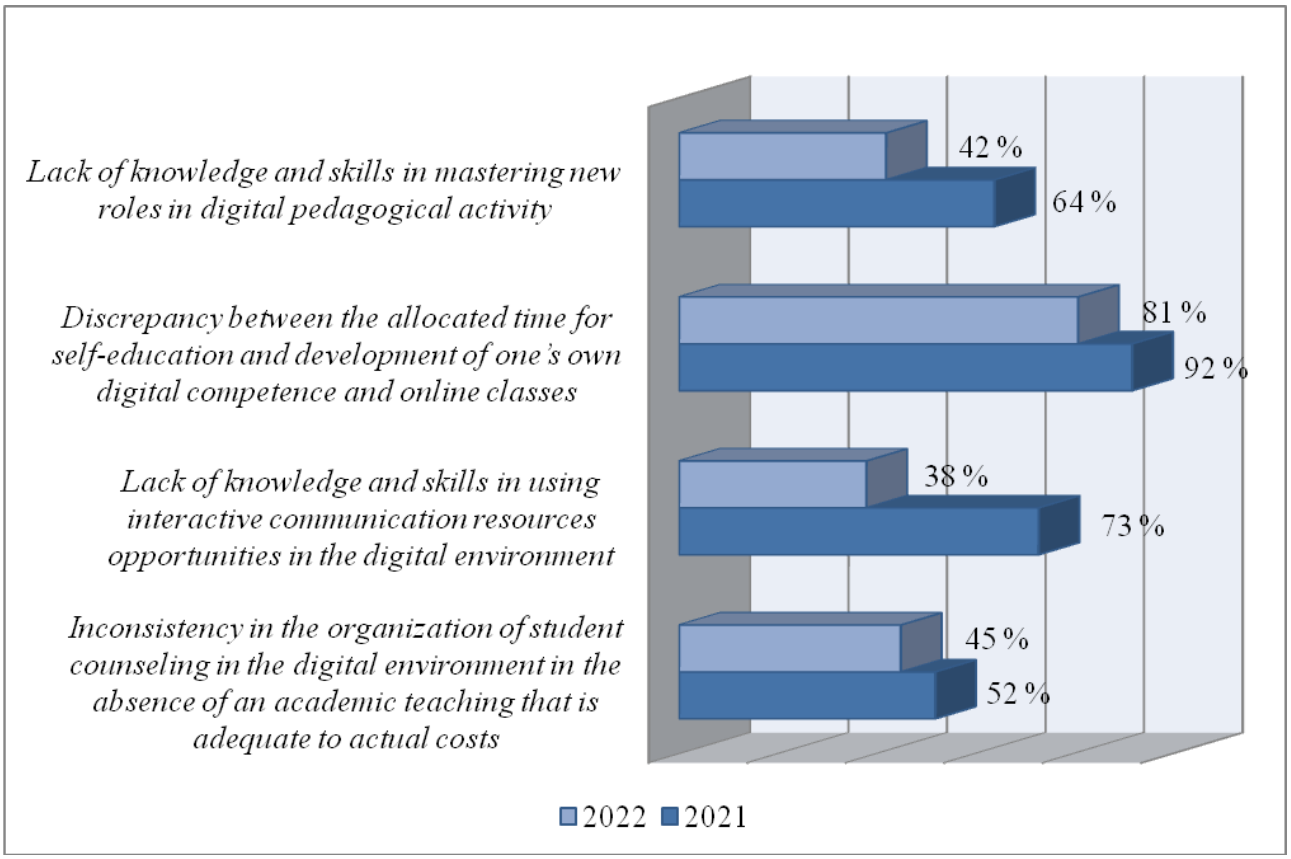


**Fig. 1.** Attitude to changes in pedagogical activity when working in digital educational environment of the universities among survey participants (instructors) 2021–2022

Calculation of Student's t-test when comparing relative values shows that differences are statistically significant. Analyzing the questionnaire's answers the following facts have been noticed. Among other drawbacks, most instructors noted:

- Inconsistency in the organization of student counseling in the digital environment in the absence of an academic teaching that is adequate to actual costs.
- Lack of knowledge and skills in using interactive communication resources opportunities in the digital environment (soft skills).
- Discrepancy between the allocated time for self-education and development of one's own digital competence and online classes.
- Lack of knowledge and skills in mastering new roles in digital pedagogical activity.

The results of the research show that various digital resource applications have different impact on students' and instructors' digital competences development, thus influencing their

consistency in teaching and learning. We can follow positive dynamics in mastering new roles in educational environment and interactive communication.

## 5. Conclusion

Given that distance learning is increasingly becoming an integral part of mainstream education; it is worth identifying the factors influencing its performance and identifying the key factors for its success. Our results suggest that the key factors that predicted teacher participation in the emergency transition to online learning were the level of technical equipment of the educational institution, the asynchronous or synchronous modality, and the level of preparation of teachers to cope with them (digital competences). It is suggested that the situation with online learning may well represent a "new reality" that will need to be continued, focusing on how the use of technology to provide educational services, online learning will continue to evolve as education develops. Existing technological advances that are being used in higher education have helped overcome the limitations of space and time during the COVID-19 pandemic (Andryuhina et al., 2020). The essence of digital transformation is to effectively and flexibly apply the latest technologies to move towards a personalized and result-oriented educational process. It can be assumed that the main goal of the further development of education is the formation of the so-called "digital teaching staff", the formation and development of digital competencies of teachers. This indicates the need to improve the skills of teachers in the use of ICT as the main guide for professional development and use not only in the extreme conditions of the pandemic, but also in everyday life. Digital educational systems should be viewed as a continuously evolving entity that will change and be updated depending on changes in technology and in accordance with the requirements of the time. Creating research forecasts regarding the future of a particular area of professional activity, of course, causes certain difficulties. As part of the implementation of such a forecast, one can rely on existing Russian and foreign research, as well as on the practical experience of past years. The results obtained, of course, will be inaccurate, but the main goal of this work is to identify trends and directions of change, try to see significant shifts and determine the prerequisites for the possible formation of new types of professional activity. Such an approach will make it possible to implement the concept of advanced learning and use already developed programs and technologies for the further development of the education system.

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