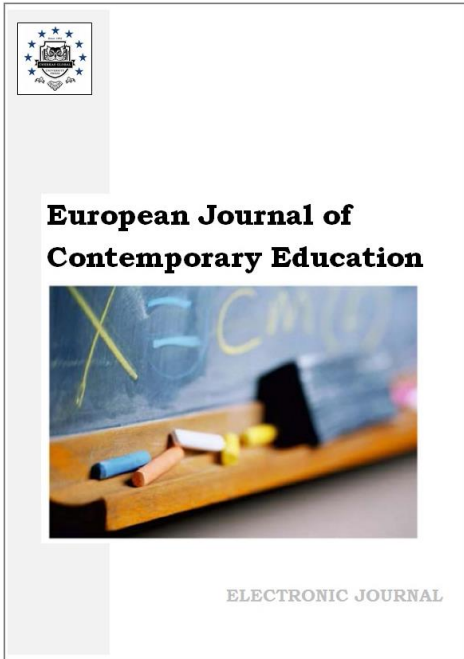




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Digitalization of Higher Education: New Trends and the Factors that are Associated Students' Grades

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Abstract

The purpose of the study is to analyze the factors that are associated the attitude of students to the processes of digitalization of higher education. The key research method is a questionnaire survey of students (N = 1107) conducted in June-November 2021. The results of the study showed that students, for the most part, positively perceive the processes of digitalization of education. Respondents recognize online learning during quarantine restrictions as an integral part of the digitalization of education. Personal experience and assessments of a number of characteristics of online learning have had a significant impact on the attitude to the digitalization of education in general. The dominant factors were a clear control system and clear presentation of the material. The factor "sufficient time to communicate with the teacher" received the least weight. Despite its significance, when answering the clarifying question, students' opinions were divided. Less than half of the respondents (43 %) believe that digital technologies have a negative impact on the learning process by reducing the time of live communication between the teacher and students. At the same time, the students unanimously believe that the use of digital technologies in the educational process is a factor in improving the quality of education, a competitive advantage of an educational organization.

Keywords: digitalization of education, teacher-student interaction, knowledge control and assessment, digital technologies, student attitudes and assessments.

1. Introduction

Digitalization is rapidly changing many spheres of social life: the structure and forms of employment, lifestyle, leisure, consumer practices, communications (Levashov, Grebnyak, 2021).

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The sphere of education, both secondary and higher, has also been seriously affected (Ivanova, Chernyakov, 2021). A number of studies emphasize that the digitalization of education as a complex process affects two aspects. On the one hand, we are talking about the formation of a comprehensive digital infrastructure, intensive use of innovative equipment and software. On the other hand, digitalization implies the development of a high-tech learning environment, new forms of pedagogical work aimed at overcoming time and spatial constraints, ensuring an individual approach to each student (Saari, Sääntti, 2018).

The intensive development of digitalization of education has become a response to epidemiological challenges, an option for implementing an “emergency solution” in order to make distance learning possible (Taglietti, 2021). The transition of education to the virtual space during the pandemic made it possible to protect all participants from epidemiological threats, and also made it possible to rethink the basic concepts and the very concept of education in such aspects as competencies and the role of a teacher in education (Frolova et al., 2020), the development of the digital infrastructure of universities (Al-Msie'deen et al., 2021; Al Sawy, 2021), and educational inequality (Grigoriev, 2021; Zolotareva, 2021). Such an understanding, in our opinion, is extremely necessary, given the fact that mixed, hybrid forms of education integrating virtual and traditional educational practices are becoming a new reality in modern conditions.

Russian and foreign scientific studies emphasize that national governments have not always critically interpreted the experience of an emergency transition to a remote learning format. This conclusion was made in the work of M. Mitescu-Manea, L. Safta-Zecheria, E. Neumann, V. Bodrug-Lungu, V. Milenkova and V. Lendzhova based on the materials of a comparative study in four countries: Romania, Hungary, Bulgaria and the Republic of Moldova. It is noted that the efforts of the authorities were primarily aimed at ensuring the continuity of the educational process. At the same time, the analysis of new emerging dysfunctions, threats, vulnerabilities and needs of students was on the periphery of the attention of the authorities (Mitescu-Manea, 2021). Based on this point of view, the authors of this article believe that modern research on education problems should focus on the needs of students, the risks of intensive digitalization of the educational process. Such risks, first of all, can be attributed to the following: lagging in studies (Canvas, 2020), digital inequality (Márquez-Ramos, 2021), increasing depression, stress and anxiety among students (Ho, Huynh and Chi, 2021), an increase in the burden on teachers (Vinichenko, 2021), a drop in motivation to form sustainable knowledge, a decrease in concentration (Frolova, Rogach, 2021).

In modern conditions, an important factor in increasing the effectiveness of digitalization of education is the development of a productive digital environment in universities, where access to online resources, the knowledge control system has a high level of transparency for students. As emphasized in the study by S.P. Ramasamy, A Shahzad, R Hassan, the ease of using elements of the digital environment has a positive impact on students' grades and their attitude to digital learning (Ramasamy, 2021). Based on these provisions, the authors in their work identify the following as key factors affecting the effectiveness of training in the context of digitalization: a clear control system, and facilitated search for materials. In this context, it is extremely important that universities have the opportunity to choose the vector and pace of modernization of their digital environment independently, taking into account their resources and limitations, the needs of both teachers and students. A number of foreign studies conclude about negative trends caused by organizational pressure on universities, the imposition of certain strategies and tactics for the development of digitalization “from above”. Therefore, S Bayne and M. Gallagher say that universities need to determine the content and forms of “their digital future” independently, based on the principles of collectivity and participation (Bayne, Gallagher, 2021).

An important aspect of research on the problem of digitalization of education is the search for the contours of a new digital pedagogy. A number of scientific articles conclude that it is necessary to integrate the efforts of all stakeholders (teachers, students, local communities) in the design of new curricula (Miller, Liu, 2022). We should note that in modern conditions, the role of local communities could be significantly expanded from management practices for organizing the life support of the territory to participation in the development of the social sphere, including determining the vector of educational policy of local educational institutions (Medvedeva et al., 2021).

G. Ladson-Billings emphasizes the need for curricula to match the culture of students. In his opinion, the new pedagogy assumes reliance on collective experience, decentralization of corporate educational materials, and transformation of the knowledge assessment system, which in modern

conditions should become not so much a “punitive tool” as a means of diagnosing competencies (Ladson-Billings, 2021). Developing this idea, A. Heinonen and S. Tuomainen draw attention to the importance of such factors of control system efficiency in the conditions of digitalization as usability and flexibility (Heinonen et al., 2020)

Special attention in the conditions of intensive digitalization should be paid to the human factor, the preservation of optimal parameters of the communication field between students and teachers (Fenwick, Edwards, 2016). As emphasized in T.A. Chelnokova’s study, digitalization requires a different mentality from the teacher (Chelnokova, 2020), new digital competencies to maintain the required level of interactivity (Grebnyuk, 2020).

Based on the results obtained, the authors, when developing the tools of the questionnaire survey of students, included various indicators characterizing the process of interaction between a teacher and a student in the conditions of digitalization.

The purpose of the study is to analyze the factors that are associated the attitude of students to the processes of digitalization of higher education.

The main hypothesis: the key factors that are associated the attitude of students to the processes of digitalization of higher education are the following: interest in learning tasks, clarity of the knowledge assessment system.

Additional hypotheses:

- Modern students positively assess the processes of digitalization of higher education.
- Reducing the time for interaction with the teacher is not the dominant factor that has a negative impact on attitudes towards digitalization processes.

2. Methods

During the preparation of the article, the authors used both general scientific (analysis, synthesis, comparison) and empirical research methods. The key research method was a questionnaire survey of students of Russian universities (on the Internet). The survey was conducted in June-November 2021. The questionnaire was posted on the Google platform. Participation in the survey was voluntary. The principles of forming a sample of respondents: the snowball method (students sent an invitation to participate in the survey), spontaneous selection (the link to the questionnaire was distributed through social networks, virtual student communities). The total number of the respondents was 1107 people. During the interpretation of the survey results, Pearson’s Chi-Square test of independence has been used to determine if there is a significant relationship between two nominal (categorical) variables, which made it possible to identify the relationship between factorial and effective signs.

To study the dynamics of the respondents’ assessments, the authors conducted a comparative analysis of the results of this survey with a survey conducted in February – April 2020 (N = 1553).

3. Results

The experience of distance learning during the pandemic has not changed the positive attitude towards the digitalization of education (Figure 1). Therefore, in 2020, 16.2 % of the respondents assessed these processes “negatively” or “rather negatively”, in 2021, while maintaining the overall distribution (16.1 %), there was a slight increase in the share of categorically minded respondents. In 2020, the answer “negative phenomenon” was chosen by 4.6 % of the respondents, then in 2021 – 8.2 %.

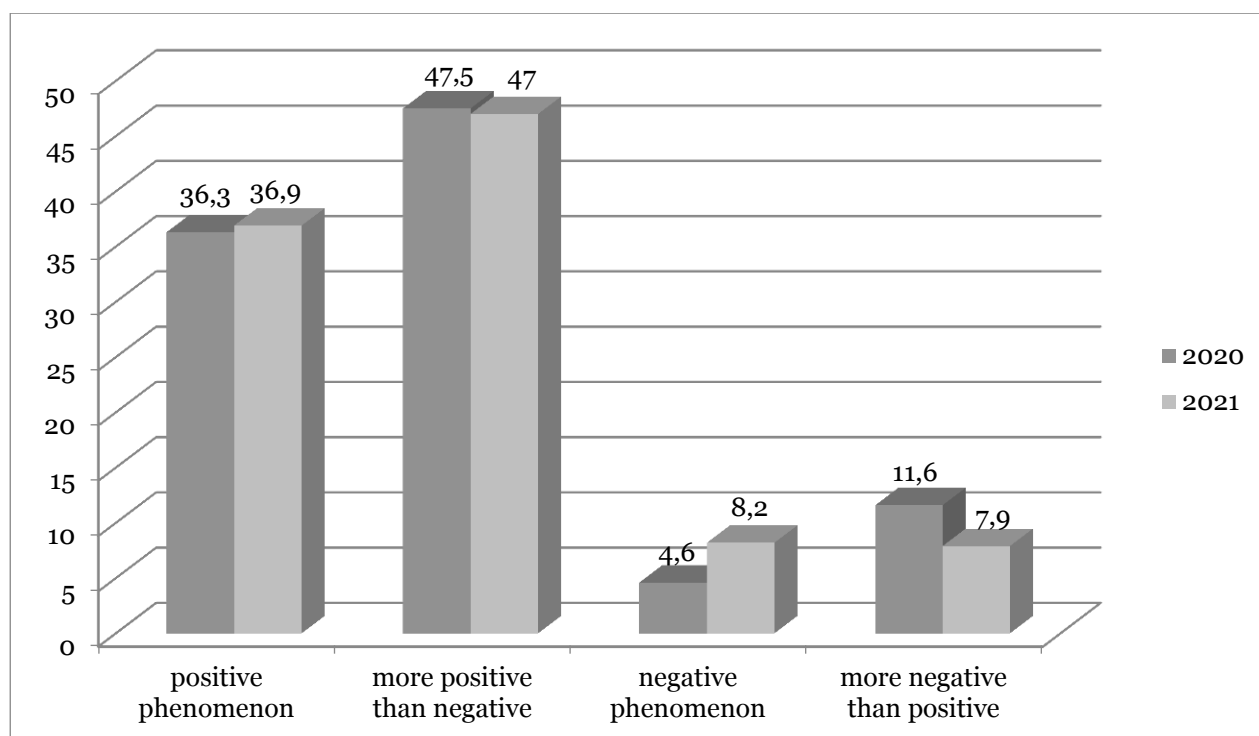


Fig 1. Distribution of answers to the question: «How do you think the digitalization of education in general is ...» in 2020 and 2021, %

Based on the data obtained, we established a relationship between the attitude of the students to digitalization and their assessment of the quality of tasks performed (Table 1). In particular, the students who, by personal example, evaluate the teacher's tasks as uninteresting are more likely to consider digitalization a negative phenomenon (grades are higher than the sample average by 8.4 percentage points).

Table 1. Distribution between students' attitude to digitalization and their perception of the quality of tasks performed (criterion "interesting"), pers

Evaluate on a personal example the characteristics of the educational process in the context of digitalization: interesting tasks	Do you think that digitalization of education is ...?		Total
	«negative phenomenon» and «more negative than positive»	«positive phenomenon» and «more positive than negative»	
Possible answer			
Yes	101	688	789
No	78	240	318

The value of the Pearson's chi-square test is 22.996. At a significance level of $p = 0.01$, the critical value of χ^2 is 6.635. Distribution between factorial and performance characteristics is statistically significant at the level of perception $p < 0.01$. The significance level is $p < 0.01$.

The data presented in Table 2 illustrate the importance of another factor influencing the attitude of students to the processes of digitalization. Among the students who negatively assessed the clarity of the control system in the conditions of remote learning, the proportion of those who

have a negative attitude to the digitalization of education is higher (26.5 %, which is higher than the average values by 10.4 percentage points).

Table 2. Distribution between students' attitude to digitalization and their assessments of the clarity of the control system, pers

Evaluate on a personal example the characteristics of the educational process in the context of digitalization: clear control system	Do you think that digitalization of education is ...?		Total
	Possible answer	«negative phenomenon» and «more negative than positive»	
Yes	88	675	763
No	91	253	344

The value of the Pearson's chi-square test is 38.938. With a significance level of $p = 0.01$, the critical value of χ^2 is 6.635. Distribution between factorial and operational characteristics is statistically significant at the perception level of $p < 0.01$. The significance level is $p < 0.01$. Thus, the value of χ^2 in assessing the factor "clarity of the control system" has more weight for the students than interesting tasks.

Table 3 shows the distribution of the students' responses when assessing such characteristics of the educational process as a facilitated search for materials in the conditions of digitalization and the general attitude to the digitalization of education. The data obtained in the course of the study allow us to conclude that the facilitated search for materials in the conditions of digitalization, being a significant factor, nevertheless does not belong to the dominant ones. The generation of digital aborigines (D'yakova, Sechkareva, 2019) feel free in the Internet space and for the most part do not have difficulty finding information. An indirect confirmation of this conclusion is the distribution of time that the students spend searching for information. In particular, only 8.1 % of the respondents spend more than 60 minutes searching for the necessary information in preparation for a lesson. The majority of students take no more than half an hour for this (58.1 %)

Table 3. Distribution between students' attitudes towards digitalization and their ratings of ease of finding materials, pers

Evaluate on a personal example the characteristics of the educational process in the context of digitalization: easy search for materials	Do you think that digitalization of education is ...?		Total
	Possible answer	«negative phenomenon» and «more negative than positive»	
Yes	124	782	906
No	55	146	201

The value of the Pearson's chi-square test is 22.700. With a significance level of $p = 0.01$, the critical value of χ^2 is 6.635. Distribution between factorial and operational characteristics is statistically significant at the perception level of $p < 0.01$. The significance level is $p < 0.01$. Thus, the value χ^2 illustrates the fact that the factor of facilitated search of materials is less associated than the clarity of the control system (38,938) and interesting tasks (22,996).

During the analysis of the data presented in Table 4, the hypothesis was partially confirmed that the reduction of time for interaction with the teacher is not the dominant factor that has a negative impact on attitudes towards digitalization processes. In particular, in the group of students who confirmed the lack of time to communicate with a teacher in the conditions of digitalization, the proportion of those who assess the processes of digitalization of education in a negative way is slightly higher (20.7 %, which is higher than the average values by 4.6 percentage points).

Table 4. Distribution between students' attitude to digitalization and their estimates of the adequacy of time to communicate with the teacher, pers

Evaluate on a personal example the characteristics of the educational process in the context of digitalization: little time to communicate with the teacher	Do you think that digitalization of education is ...?		Total
	Possible answer	«negative phenomenon» and «more negative than positive»	
Yes	135	516	651
No	44	412	456

The value of the Pearson's chi-square test is 24.323. At a significance level of $p = 0.01$, the critical value of χ^2 is 6.635. Distribution between factorial and performance characteristics is statistically significant at the level of perception $p < 0.01$. The significance level is $p < 0.01$.

Despite the presence of a connection between these signs, the impact of reducing the time spent on communicating with the teacher is not the dominant factor in the formation of negative ratings digitalization of education in general.

A comparative analysis of the materials of the first and second waves of the study (Figure 2) allows us to conclude that there have been no significant transformations in the opinion of the students during the period of distance learning. At the same time, we can talk about the emerging trend. Having adapted to the new conditions, the students feel less lack of time to communicate with the teacher. At the same time, more than half of the respondents surveyed, both in 2020 and in 2021, admit that the digitalization of education reduces the time of their interaction with the teacher.

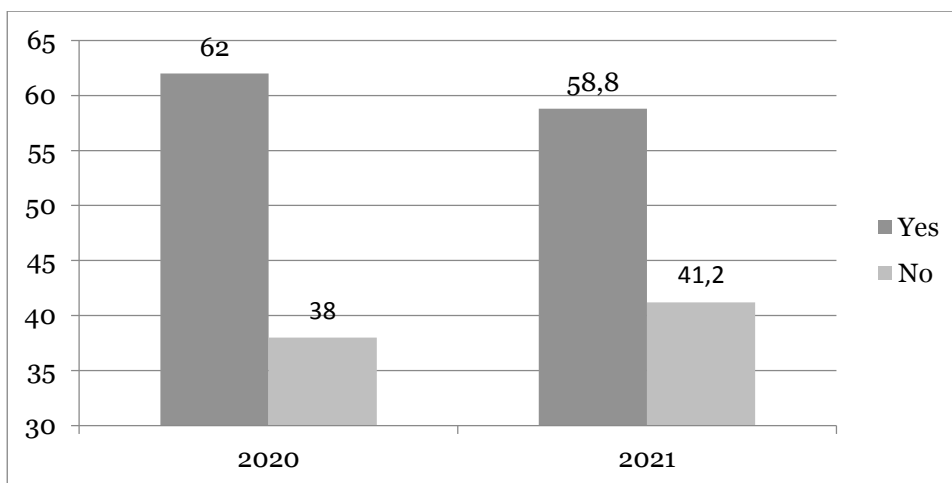


Fig. 2. Distribution of answers to the question: “Do you agree with the statement that in the context of digitalization, a student has little time to communicate with a teacher?”, %

In addition to this question, the study attempted to find out the respondents' attitude to the compression of the boundaries of direct interaction between a teacher and a student. We should note that the results of the study illustrate the lack of an unambiguous opinion of the students on this aspect of the digitalization of education. Answering the question: "Do you agree with the statement that digital technologies negatively affect the learning process by reducing the time of live communication between the teacher and students?" 43 % gave a positive answer, 38.2 % disagreed with this statement. Almost every fifth respondent (18.8 %) found it difficult to answer. Interestingly, when answering the question whether the use of digital technologies in teaching is a competitive advantage of an educational institution, the respondents were more unanimous in their assessments. Almost 2/3 (65.7 %) of the surveyed students answered yes to this question. 70.1 % believe that digitalization is an important condition for improving the quality of education. In 2020, 67.4 % of the respondents agreed with this statement.

The analysis of the data in Table 5 allowed us to establish a factor that is a dominant associated on the attitude of students to processes of the digitalization of education. Of interest is the fact that the introduction of digital technologies into the educational process allows you not to spend a lot of time searching for information in preparation for the lesson, but at the same time actualizes the factor of accessibility of presentation materials from the teacher.

Table 5. Distribution between students' attitudes towards digitalization and their assessments of the accessibility of presenting materials, pers

Evaluate on a personal example the characteristics of the educational process in the context of digitalization: clear presentation of materials	Do you think that digitalization of education is ...?		Total
	Possible answer	«negative phenomenon» and «more negative than positive»	
Yes	82	658	740
No	97	270	367

The value of the Pearson's chi-square test is 42.641. The critical value of χ^2 at the significance level $p = 0.01$ is 6.635. Distribution between factorial and performance characteristics is statistically significant at the significance level $p < 0.01$. The significance level $p < 0.001$. Thus, these values show the strongest relationship between the attitude of students to the digitalization and the availability of presentation materials. Among those students who, by personal example, did not experience difficulties with the educational material, the vast majority of 88.9 % positively assessed the digitalization processes, which is higher than the average values by 5 percentage points. An even more pronounced dependence is characteristic of a group of students who negatively assessed the availability of presentation materials in the conditions of digitalization. Among them, one in four (26.4 %) negatively perceives the introduction of digital technologies into the educational process (above average values by 10.3 percentage points).

Summarizing earlier conclusions, we can conclude that the hypotheses of the study have found partial confirmation. The key factors in the formation of students' assessments of the processes of the digitalization of education are the following: accessibility of presentation of materials, clarity of the control system. The interest in assignments, the facilitated search for materials and the sufficiency of time to communicate with the teacher, while remaining statistically significant factors, at the same time do not occupy leading positions.

4. Discussion

The analysis of the obtained results illustrates the “digital optimism” in the student environment, the respondents’ assessments of the digitalization of education are centered in the boundaries from “positive phenomenon” (36.9 %) to “rather positive” (47 %). The results of the study showed the existence of a stable relationship between the students’ personal learning experience and their estimates of digitalization. Among all the characteristics of the educational process, the value of the indicators “clear presentation of materials” and “clarity of the control system” has the greatest weight. We can assume that in the conditions of remote learning and the reduction of personal contacts with the teacher, students are interested in an accessible understanding of the material, transparent criteria for assessing knowledge. As emphasized in the study by O. Zlatkin-Troitschanskaia, J. Schlax and J. Jitomirski, fairness in the system of control of students’ knowledge is one of the most important criteria for the quality of education (Zlatkin-Troitschanskaia et al., 2019). In the conditions of digitalization, the knowledge assessment system is most susceptible to algorithmization. Tests as forms of knowledge control are becoming the most common practice in modern universities. The results of education are converted into digital form: from “the learning process in the classroom and knowledge assessment” to “management and administration” (Williamson 2017). A number of authors see a positive impact of the digitalization processes on the modernization of the students’ knowledge assessment system. In particular, the opinion is given that digital technologies provide updating of existing performance monitoring tools, and ensure transparency of assessment results (Campelj et al., 2019). In contrast to this point of view, C. Malott puts on the agenda a number of issues related to the effectiveness of algorithmized knowledge assessment systems. The idea is expressed that algorithms, approved protocols of knowledge assessment and compulsory practices limit creativity of a teacher and a creative approach in teaching. Considering alternatives to trends in the development of education in the future, the scientist suggests that algorithmic training programs, bots, can replace the teacher (Malott, 2020). Complementing this point of view, M. Manikovskaya believes that the formalization of the educational process, the deterioration of interpersonal communication skills are key threats to the digitalization of education (Manikovskaya, 2019)

At the same time, the results of the study showed that the students perceive the reduction of direct contacts with the teacher in the conditions of digitalization very ambiguously. The respondents’ opinions were divided on this issue, however, those students who personally experienced a lack of time to communicate with the teacher, in general, perceive the process of digitalization more critically, considering it a negative phenomenon. We should mention that there is also no consensus in the scientific literature on this issue. S. Bayne and P. Jandrić disputes the claim that personal interaction and presence is a privileged form of learning and the most authentic way to gain knowledge. Scientists believe that online learning is becoming a new reality, and with the right approach, it will provide access to high-quality education for the general population (Bayne and Jandrić, 2017). N.B. Strelakova, in contrast to this opinion, believes that the reduction of personal contacts in the learning process leads to a loss of fundamental education (Strelakova, 2019). Of interest is the point of view of J. Suoranta, which justifies the need to integrate traditional pedagogical forms of work into the digital educational environment, considers teaching, on the one hand, as an art, and, on the other hand, as an algorithm of actions with mandatory reliance on digital technologies (Suoranta et al., 2021).

The results of our study are compatible with these conclusions. Such characteristics of the educational process as “interesting tasks”, “clear presentation of the material”, “a clear control system” have a significant impact on perception of the digitalization process in the student environment. In modern conditions, the formation of a creative learning environment is the most important factor in maintaining interest in learning. In this context, it is important to integrate the teacher’s pedagogical skills and innovative digital technologies embedded in the educational infrastructure of the university. The study showed that modern students are no longer as interested in the personal presence of a teacher. While the use of digital technologies, in their opinion, is an important competitive advantage of an educational institution, a condition for improving the quality of education.

5. Conclusion

The results of the study show that students of Russian universities positively perceive the process of digitalization of higher education. Distant learning, the introduction of quarantine restrictions did not have a significant impact on the respondents' assessments. A comparative analysis of the results of two surveys in 2020 and 2021 showed that the proportion of the students who positively assess the processes of digitalization has practically not changed. We should note that the majority of the respondents believe that digitalization is an important condition for improving the quality of education (67.4 % in 2020, 70.1 % in 2021). The correlation analysis revealed determinants that determine the perception of digitalization in the student environment: a clear control system, clear presentation of the material, interesting tasks, facilitated search for materials, and the amount of time allotted for communication with the teacher. Despite the fact that those respondents who feel a lack of time to communicate with a teacher, for the most part, more often assess digitalization as a negative impact, the results of the study illustrate the lack of unambiguous opinions regarding these trends. Students' opinions were divided when answering the question: "Do you agree with the statement that digital technologies negatively affect the learning process by reducing the time of live communication between the teacher and students?" Similarly, there are polar positions in scientific discourse. On the one hand, there are concerns about the risks of formalization of learning, deterioration of communication skills in conditions of compression of the boundaries of interaction between a teacher and a student. On the other hand, the conclusion is justified that "live communication" today is not an attribute of privileged learning, a factor in improving the quality of education. It can be assumed that direct communication between a teacher and a student is not one of the dominant needs of young people today. While the use of digital technologies in the educational process is unanimously perceived as a factor in improving the quality of education, the competitive advantage of the university.

Taking into account the students' request for the introduction of digital technologies into the educational process, further research directions on this topic may be the following: mechanisms for integrating traditional and digital pedagogy, analysis of the long-term consequences of reducing the boundaries of teacher and student communication, search for alternative forms of the educational process, compensators for negative consequences of the digitalization of education.

6. Limitations

The limitations of this study include the use of random sampling, which does not fully represent all categories of students. Studies of the digitalization of education on the example of higher education justify the choice of a spontaneous sample, but further analysis of digitalization processes requires coverage of a wider range of respondents with all the characteristics of representativeness.

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