Evaluation of the effectiveness of the use of digital educational technologies in the educational process of a university

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Abstract. The paper presents a comparative analysis of the effectiveness of the use of various learning technologies: digital, traditional, and blended learning in the educational process of a university. The authors show the results of research related to the analysis, development, and refinement of parameters, capabilities and implementation of digital technologies in the educational process. The analysis is carried out based on a set of surveys of students and teachers. A comparison of the impressions of the participants of the educational process and an analysis of its results during the transition from the classic model of the educational process to a blended (classic model with the use of digital educational technologies) anddistance learning is carried out. The results obtained were correlated with objective indicators — compliance with the academic schedule, average academic performance, and the level of residual knowledge. Significant advantages and disadvantages of the introduction of distance learning in the educational process were identified, on the part of both trainees and teachers. In conclusion, the authors summarize that the use of digital technologies makes it possible to create a learning environment around the student that forms professional digital innovative competencies.
Keywords: educational technologies: traditional, digital, blended; higher education, motivation, distance learning

1   Introduction

There is the intensive use of digital technologies in the educational process in today's world, which is inextricably linked with the achievements of the scientific and technical development. The use of digital (information and communication) technologies in education is due to the epidemiological situation that causes the need to reformat full-time education systems. Therefore, conducting research related to the analysis, development, refinement of parameters, capabilities and implementation of digital technologies in the educational process seems very relevant.

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The purpose of our study is to evaluate the dependence of the effectiveness of the educational process on the level of the use of digital educational technologies. The authors are going to analyze the opinions of students and teachers and compare them with objective indicators – compliance with the academic schedule, average academic performance, and residual knowledge.

The study was conducted in 2020-2021 based on the educational process of the Lobachevsky State University of Nizhniy Novgorod. A comparison was carried out in assessing the impressions of the participants of the educational process and an analysis of its results during the transition from the classic model of the educational process to blended (classic model with the use of digital educational technologies) and distance learning.

2   Materials and methods

The results of data analysis of 48 e-learning courses (hereinafter referred to as "online courses") were considered as well as the results of online surveys of teachers and students working with these courses, and data from scientific publications. The general number of students of the Lobachevsky State University of Nizhny Novgorod who attended these classes was 3942.

3   Results and discussion

The analysis of the works of foreign and Russian authors shows that the use of digital technologies in education can be effective only with their rational use; the application of a model of student activity aimed at capabilities and personal qualities of students [1-4]. The need to dose the level of application of online technologies in education is also emphasized by the fact that there is almost no distance education in elite educational institutions in the USA; a blended model is used that combines the advantages of classic education with the innovative capabilities of digital technologies [5].

In order to determine which of the models of the educational process most fully meets the needs of students, we offered a number of tasks for students completing an online course. The first is to rate on a five-point scale the preference for using these models when studying a particular subject (see Table 1). Subjects are roughly divided into three groups — humanities, natural sciences and mathematics.

Table 1. Preferred use of a particular learning model

Subjects	Classic model	Blended model	Distance model
Humanities	3.64	4.25	3.88
Natural sciences	4.51	4.35	3.76
Mathematics	4.25	4.0	3.65

As shown in the table, our people under test evaluate the application of models of the educational process in the study of different subjects in different ways. These results are identical with the results obtained by Kruchinin et al. in a similar study [6].

The second task was to list the advantages (see Table 2) and disadvantages (see Table 3) in the use of digital technologies.

Table 2. Benefits of usingdigital technologies in education

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Advantage	Frequency of mentions (%)
Mobility	92
Availability of educational materials	85
Transparency in the assessment of test tasks, the possibility of re-passing a test	65
Modern technologies	52
Possibility of applying in further (professional) activities	32

Table 3. Disadvantages of usingdigital technologies in education

Disadvantage	Frequency of mentions (%)
Lack of direct contact with a teacher, lack of emotional support and motivation	62
Obscurity of the methodology for assessing skills and abilities	51
Technical problems, insufficient knowledge of digital technologies	28

According to the survey results, the level of use of digital educational technologies fully meets the needs of students. Most students realize that the professions they plan to get are increasingly shifting to digital technologies [7]. That is probably why students emphasize that the acquired competencies can be applied in further activities. It is senior students who most often bring this consideration (64%). Junior students more often mention the lack of direct contact with a teacher (92%).

The analysis of e-course data shows that more than 80% of students on distance learning complete their training tasks on time. This indicator is the same for senior students and junior students. However, most first-year students (up to 10%) stop completing assignments. There are practically no such students in senior courses. With blended learning, this effect is much less pronounced. Obviously, insufficient motivation for studying and bad skills of self-organization of first-year students are important here [8, 9]. It is preferable for yesterday's schoolchildren to interact with a teacher directly — not only Russian researchers point to this problem [10].

Tables 4 and 5 show the main advantages and disadvantages of using digital technologies according to the results of a survey of teachers.

Table 4. Benefits of using digital technologies in education

Advantage	Frequency of mentions (%)
Possibility of operational control of achievements of each student	82
Possibility of modelling situations that allow you to imitate the professional activity	80
Availability of educational materials	65
Visibility	62

The first significant advantage of the introduction of digital technologies the teachers call the possibility of operational control of the achievements of each student [11]. The classic model of education does not allow evaluating all students at each lesson, saving

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information on mistakes made, etc. Digital technologies allow this information to accumulate, analyze and adjust the educational process respectively [12].

Moreover, the use of online technologies allows you to simulate situations that imitate the educational activity of students. In this case, a student does not just accumulate knowledge; he or she learns to act [13] and builds ability and skills [14]. In fact, the use of digital technologies makes it possible to create a learning environment around the student [15] forming professional competencies. Considering the digitalization of all sectors of the economy, it can be assumed that it is digital competencies that will be innovative in the near future, and will be most in demand by employers [16].

Table 5. Disadvantages of using digital technologies in education

Disadvantage	Frequency of mentions (%)
Lack of direct contact between a teacher and a student	91
Low motivation of students	57
Insufficient reliability of evaluation	55
Technical problems	42
The complexity of continuous maintenance of the course	39
Inability to perform experiments and laboratory work	22
Putting intellectual property on public access.	9

The data from the teachers' survey show that the main risk is the loss of teacher-student contact. Western authors also point to this problem [17]; the consequence is a decrease in the motivation of students on distance learning [7]. The problem of low reliability of evaluation is also widely recognized. It is confirmed by the fact that in 2018, fifteen major American companies such as Apple, Bank of America, Google, and Hilton allowed the possibility of hiring job seekers without taking into account their academic certificates [18]. Based on the analysis of our research data, it is not possible to determine the way students' academic performance changes when using digital educational technologies. According to the annual control of residual knowledge, the final grades of the tested students turned out to be not significantly lower than the indicators of students of previous courses who studied the same subjects in the classic learning model.

4   Conclusion

The problem of the reliability of the evaluation as well as other problems mentioned by teachers can be resolved with a reasonable dosage of elements of the classic model of the educational process and digital educational technologies.

Therefore, we can see an increasing role of digital technologies in the formation of innovative competencies of future specialists. However, when digital educational technologies are included in the educational process, as with any innovative process, it is necessary to analyze and take into account possible risks.

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