Research of the Readiness of the University's Educational Environment for the Organization of Combined Learning

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Abstract. The COVID-19 coronavirus pandemic has challenged all spheres of life, including the education system. In March 2020, Belgorod State National Research University (NRU "BelGU"), like many other universities in the Russian Federation, switched to distance learning. Internal online courses were used to organize the learning process, as well as elements for synchronous classes in the form of videoconferences. Classes in such study groups are organized in a combined learning mode (in the classroom - for full-time students, and videoconferences are used for part-time students). This way of organizing the educational process was used in NRU "BelSU" long before the pandemic. It allows students who are forced to study remotely to participate in the educational process with the "effect of real presence". The article presents the results of the research aimed at identifying the readiness of the educational environment of NRU "BelSU" for blended learning. The study showed that the forced transition to the distance format became a catalyst for the development of the information and educational environment of the university and increased the level of readiness of the teaching staff to use digital educational technologies in the educational process.

Keywords: combined learning · heterogeneous study groups · hybrid classes · information and educational environment of the university · online course · videoconference · distance learning · technical equipment of classrooms

1 Introduction

In 2015, the Belgorod State National Research University (NRU "BelGU") raised the question of the possibility of implementation of training entirely in a distant format in order to attract applicants for distant education from remote regions and other countries. At that time, there was more than 10 years of experience of organization of the educational process for part-time students using distance learning technologies (a mixed format with shortened sessions). An acceptable option was to conduct classes for remote students in the video conferencing, but not all students were ready to study online, for many of them is

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was more convenient to participate in offline classes. Thus, we had heterogeneous student groups, where some students were ready to study in the classroom, and some students were willing to receive education completely remotely. It was economically unprofitable to divide the educational process of the study group into traditional and remote ones. There was a need to combine two educational spaces – real and virtual. This mode of organization for the educational process, when the lesson is simultaneously taught in the classroom and online using video conferencing technologies, we called combined learning (a combination of two educational environments). In foreign literature, there are publications, which qualify this method of organization as teaching in hybrid classes [1, 2]. However, hybrid learning is often equated with blended learning in the literature [3–6]. Therefore, to refer to the learning process for both classroom and remote students using multimedia equipment and video conferencing services, we use the concept of combined learning (CL).

Since the 2016–2017 academic year, part-time students in 13 areas of bachelor's degree training have had the opportunity to "attend" traditional classes remotely. By the 2019–2020 academic year, combined learning technologies were used in the implementation of 52 educational programs of bachelor's, specialist's and master's degrees.

The experience of using distance education technologies, "including blended learning, allowed NRU "BelSU" to quickly switch to full distance learning in spring 2020. In the conditions of full transition to distance learning, the university only needed to adapt the existing models of the educational process" [28]. Combined technologies were also utilized for the state final certification in the 2019–2020 academic year. Currently, classes for different groups of students are conducted in a blended learning format. In the 2020–2023 academic year, more than 1,200 students applied for distance learning, of which more than 60% were international students unable to enter Russia due to restrictions.

This situation served as a catalyst for the rapid development of online education at the university and actualized the need to assess the level of digital literacy of teachers of higher education institutions, since the digital competence of a teacher is a key factor in the successful implementation of innovations in education and the active involvement of students in the use of digital technologies to solve educational tasks, such as critical research and modeling of new knowledge. Later, as a result of the general transition to distance learning, almost all teachers have gained experience of teaching online classes in the webinar mode. The hardware and software of synchronous online training using video conferencing has also changed significantly. For the operation of the BigBlueButton service, 7 servers with a load balancer server are currently used, the university purchased 1,200 Zoom licenses in the fall, and 55 classrooms were additionally equipped for the implementation of classes in the combined training mode.

2 Materials and Methods

2.1 A Subsection Sample

The use of modern digital educational technologies and their reasonable combination with traditional formats of the educational process organization allow to increase the degree of accessibility of the educational process and provide an opportunity for remote

students to receive education. The problem of variable access to the educational process became especially acute during the COVID-19 pandemic, when distance education technologies were used not by choice for many students, but as a forced measure. In 2020, almost all educational institutions were forced to implement online learning technologies in one form or another. In conditions of mass isolation, a variety of methods of organizing the educational process were used, including online courses (both open and in-house), synchronous classes via video conferencing, and access to educational podcasts with the possibility of interaction via email, messengers and social networks [7–11]. In many universities, there have been situations where a part of students from one group could return to the classroom while the other part continued to study remotely. In this regard, we consider it appropriate to organize the learning process in the format of combined (hybrid) learning for such groups. Thus, the purpose of our research is to study the readiness of the educational environment of the university to organize the educational process in the mode of blended learning.

Combined learning compared to other approaches ("the use of mass open online courses" [9, 12–14], "distant learning systems" [8, 15], "video conferencing services" [10, 16], "social networks" [11, 17], "messengers" [20], etc.) allows to simulate the effect of real participation in the educational process for remote students. The teacher can teach a class simultaneously for students in the classroom and for remote students. Otherwise, it is necessary to organize the learning process for one part of the study group in the classroom according to a schedule, for other students – in the form of individual remote interaction, for example, to conduct consultations in additional time in the video conference mode. Nevertheless, despite the obvious advantages of blended learning for hybrid learning groups, its implementation requires a certain readiness of both the technical infrastructure of the educational environment of the university and the teaching staff. Therefore, first of all, it was important to assess the readiness of teachers to use modern digital educational technologies and to implement the educational process in the format of blended learning, as well as to find out the level of satisfaction of teachers with the material and technical support necessary for the organization of such training.

2.2 Methodology

The analysis of the world experience of organizing the learning process in hybrid classrooms [1, 2, 19–21] allowed the authors to make sure that there is a problem of organizing the learning process simultaneously for students who are in the classroom and those who are connected using videoconferencing (blended learning) and it still remains poorly studied. Belgorod State National Research University since 2016/2017 academic year has its own experience in this issue. This allowed the authors to conduct a study of the readiness of the educational environment of the university to organize the educational process in the mode of blended learning from 2019 to 2023. Various methods were used, including theoretical analysis of scientific literature [1, 7–11, 17, 18], comprehensive and systematic study of the research object, generalization of practical experience, etc. The empirical method included diagnostics of the teaching staff of NRU "BelSU" on the basis of questionnaires, surveys, testing for the level of teachers' readiness to use modern digital educational technologies and implementation of the educational process in the format of blended learning.

In the course of our research we analyzed the key components of readiness of both the educational environment of the university for the implementation of blended learning, and the readiness of teachers to use modern digital educational technologies in the educational process and their ability to implement the educational process in the format of blended learning. In addition, the study analyzed the indicators of teachers' satisfaction with the material and technical support of the educational environment of the university and their degree of personal interest in the organization of the educational process in this format. The data were collected in dynamics from 2019 to 2023.

3 Results

In order to identify the readiness of the teaching staff of the National Research University "BelGU" to use modern digital educational technologies in the educational process, to implement the educational process in the mode of combined training and to identify the degree of satisfaction with the material and technical support of the educational environment of the university for the organization of combined training, the authors conducted a research based on observation and analysis of survey data. The study of the dynamics of the readiness of university teachers was conducted starting from 2019, when the university switched to the full-scale use of combined learning technologies in the implementation of 52 educational programs of bachelor's, specialist's and master's degrees, and until March 2023, including the period of universal transition to distance learning and conducting online classes in the webinar mode. 481 university teachers took part in the survey, including professors (4.2%), associate professors (64.1%), senior teachers (13.9%), assistants (9.6%), directors/deans/heads of departments (8.2%).

The initial survey in 2019 showed that only 24.9% of the teachers surveyed conducted classes in a combined learning mode (simultaneous classes for full-time and distant students using video conferencing). According to their readiness to conduct classes in the combined training mode, the opinions of respondents were distributed as follows (Fig. 1): 19.0% noted that they are fully ready to conduct classes in the CL mode and already conduct classes in specialties and training areas that use this training mode; 34.6% - are rather ready to implement the educational process in the combined learning mode, because they know and understand how to use the video conferencing tools to organize classes in this mode, but do not conduct classes with the use of CL; 29.3% - are rather not ready, because they do not believe that they have sufficient skills of using distance learning technologies to interact with remote students, some are generally committed only to learning in the traditional form and do not consider this combined learning technology acceptable; 17.1% of the respondents are not ready, because they believe that they have poor skills in using digital technologies and computer technology.

According to 32.7% of respondents, the classrooms were partially equipped for conducting classes in the combined training mode, which hindered the quality of classes, 38.6% said that despite the fact that the classrooms are equipped for conducting classes in the combined training mode, they have very weak Internet and/or Wi-Fi; 33.4% noted that it is impossible to work online in the classrooms due to poor communication, and 45.2% of respondents noted that nothing prevents them from conducting classes in the combined training mode. In general, at the beginning of the study, the readiness of

Fig. 1. The readiness of teachers to conduct classes in the CL mode (at the beginning of the study)

the educational environment of the university to conduct classes in the CL mode was evaluated by teachers as follows (Fig. 2): 34.8% complained about the low technical capabilities of the university's computer networks; 32.4% of respondents complained about improper equipment in the classrooms; 19% of teachers felt that they lacked personal readiness for the CL mode; 9.7% felt that the information and educational environment of the university with the use of video conferencing elements would not allow them to conduct high-quality classes in the CL mode; 16.3% considered that students are not ready to study in the CL mode, and 12.5% found it difficult to answer.

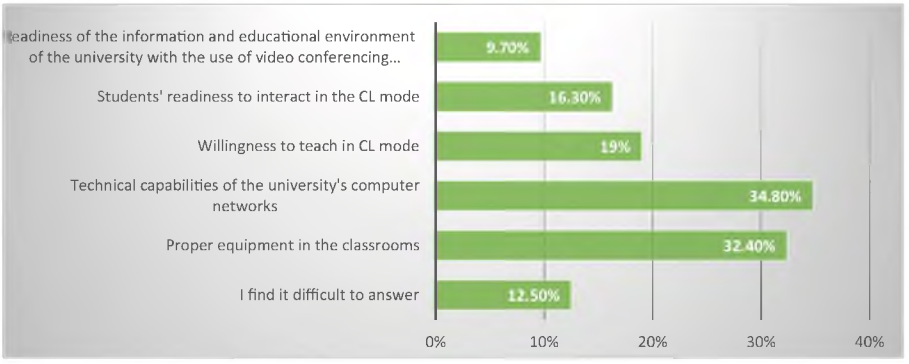

Fig. 2. The readiness of the educational environment of the university to conduct classes in the CL mode (at the beginning of the study)

The transition to distance learning in March 2020 resulted in concerns of readiness among teachers, including: a low level of availability of communication facilities for conducting classes in the video conferencing mode (23.9%); a low level of personal readiness to implement the distance learning format (14.1%); a low level of readiness of students to implement this format of training (29.5%); low technical availability of the university to switch to the distance learning format (23.3%); a decrease in the quality of the educational process (53.2%). Teachers, who before the full transition to distance learning used a combined format and applied distance education technologies,

were 45.7% ready for this transition. They had only to adapt and expand the already successfully implemented models of the educational process.

In the March 2023 survey, 44.9% of faculty indicated that their attitudes toward distance learning had improved, 37% stated that nothing had changed, and 18.1% of respondents reported a negative change in their attitudes (Fig. 3). Among the factors that contributed to the change in the attitude of teachers for the worse were the following: a large amount of time spent in front of the computer checking tasks and answers to questions (55.4%); technical problems with online services (22.3%); technical problems with the e-learning system "Pegasus" (28.8%). According to 56.9% of respondents, the quality of education was decreased, many felt that they lacked face-to-face interaction with students.

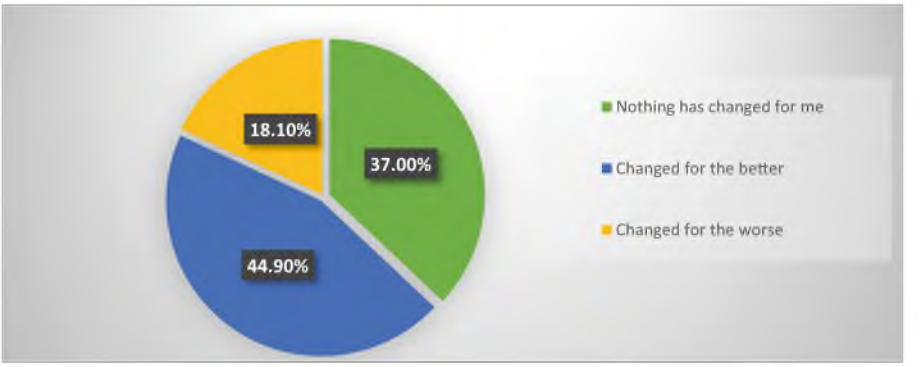

Fig. 3. Teachers' attitude to distance learning (March 2023).

To identify the degree of satisfaction with the material and technical support of the educational environment of the university and its readiness to conduct combined learning, questions were formulated to assess the level of equipment of the university's classrooms with equipment for conducting classes in a combined mode at the moment (March 2023). The respondents' answers revealed the problem of insufficient provision of classrooms with modern equipment for organizing classes in the format of blended learning, which was mentioned by 31.5% of survey participants. In addition, 30.8% noted the presence of weak Internet and/or Wi-Fi in some classrooms, and 7.9% pointed out the complete lack of connection. At the same time, 8.3% of respondents stated that all classrooms are fully equipped for blended learning, and 15.9% found it difficult to formulate an answer.

In the course of the study of teachers' readiness to effectively conduct classes in the blended learning format, we found that they lacked personal preparation. In particular, 30.8% of respondents noted a lack of digital competence and knowledge about the possibilities of digital educational technologies to organize classes in this format. In addition, 9.7% indicated a lack of knowledge and preparedness in the area of the legal and regulatory framework, 8.7% indicated a lack of instructional and methodological materials, and 12.6% indicated a need for training seminars and professional development programs; readiness of students to interact in the CL format (35.2%); opportunities

to use virtual reality technology for the implementation of combined training (12.2%); financial incentives from management (39.1%). Regarding the personal view of teachers in the implementation of the educational process in the mode of blended learning their answers were constructive: awareness of the importance of using this form in the educational process, understanding that this form of organization of the educational process will increase the competitiveness of educational programs of the university and increase the number of students (25.1%); awareness that such mode of training is simply necessary for a certain category of students, and the educational process is primarily focused on the student (41.2%); the development of new educational technologies will increase the professional level (27.3%).%); the ability to convey information to students, even if they are geographically far from the university (11.4%). As a personal motivation, faculty indicated that increased pay for teaching blended learning classes (63.1%) and additional points in the rating system (32.7%) would be important incentives for overcoming the challenges of implementing instruction in this format.

At the final stage of the study (March 2023), we were interested how the readiness of teachers to implement the educational process in the combined learning format has changed. According to the survey data, we found (Fig. 4) that 38.3% of respondents are fully ready and perfectly proficient in digital educational technologies for conducting classes in this format, 53.2% of respondents are more likely to be ready for CO, and this grants them an opportunity to receive additional incentive points in their personal rating, 6.8% - rather not ready, because the use of digital educational technologies and computer equipment continue to cause difficulties in handling them, and 1.4% - they are not ready and believe that the use of such format of classes and digital technologies in education leads to a decrease in its quality, in general.

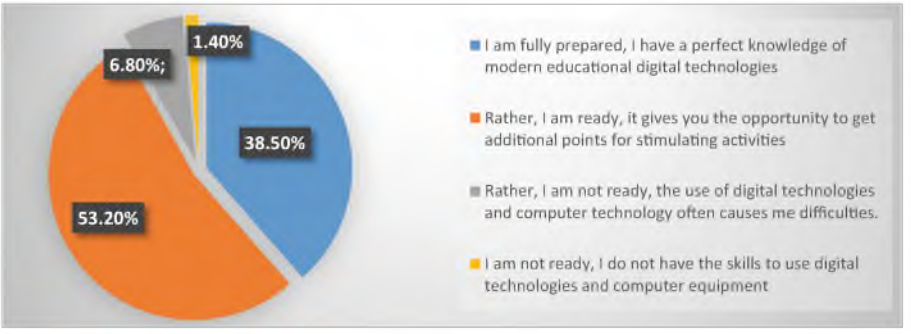

Fig. 4. Readiness of teachers to conduct classes in the CL mode (at the end of the study)

The instructions, video lessons and methodological materials developed by the authors, containing the best practices in the use of distance education technologies, including blended learning, in general, have increased the readiness of university teachers to conduct classes in the format of blended learning.

When asked whether teachers believe that combined learning technologies should be developed at our university, 69.4% answered affirmatively, 9.5% said " no" and 21.1% are at a loss to answer. The negative responses of the teachers were justified

by the following statements: "Not all types of classes can be conducted in this mode", "Combined training requires additional efforts from teachers", "I think that the university will not create conditions to encourage teachers to use combined training", "Combined training technologies will never be comparable with traditional in terms of quality", "For the sake of the quality of the educational process, you can "sacrifice" distance students", "It is better to develop distance learning using online courses", "To participate in the educational process in the combined learning mode, most students do not have the technical ability", "There are threats of reducing the teaching staff", etc.

Thus, the results of the study revealed:

1. The positive dynamics of teachers ' readiness to conduct classes in the CL mode. More than 90% of teachers consider themselves ready to organize the educational process in the combined learning mode. At the same time, the number of teachers fully prepared for such a mode of conducting classes has increased from 19% to 38.5%, most believe that this is a great opportunity to participate in the real educational process, even if the student is geographically removed. The number of teachers who tend to consider themselves more ready to conduct classes in the CL mode has increased (from 34.6% to 53.2%), because they were able to increase their level of competence in the field of digital educational technologies, improve their skills in using distance learning technologies, they have gained an understanding of the process of remote interaction with students, The number of teachers who are not ready and not at all ready to conduct classes in the CL mode has decreased (from 23.9% to 6.8% and from 17.1% to 1.4%, respectively), due to the mass transition to distant learning in 2020, since these technologies were used for conducting classes, state final certification in the 2019–2020 academic year in almost all curricula.
2. The positive dynamics of the readiness of the educational environment of the university. During the pandemic, BelSU upgraded its server and network infrastructure, equipped its classrooms with multimedia equipment, and conducted training seminars and advanced training courses for teachers in order to create favorable conditions for the implementation of the educational process in the combined learning mode, improve the quality of the educational process and the competitiveness of the university in the global educational community.

4 Discussion

The analysis of the literature shows that the problem of organizing synchronous training of distance and F2F students is poorly studied [1, 2, 19]. Interest in this approach to the organization of the educational process has increased many times during the pandemic, when many educational organizations faced the need to organize educational process for heterogeneous study groups. One possible solution is using combined learning (learning in hybrid classrooms). To ensure the possibility of implementation of combined training, the information and educational environment of the university should include a system for conducting classes in the videoconference mode. Classrooms should have appropriate equipment and access to the Internet [19]. An important condition for the use of combined learning technologies is the willingness of teachers to conduct classes in this mode. The teacher will need skills of using equipment, programs for video conferencing, and the ability to organize a combined educational environment in the classroom

for simultaneous participation in the educational process of 'real' and distant students [21].

In the literature, one of the main problems of organizing the educational process in a heterogeneous educational group using video conferencing is considered-the dependence of the quality of the educational process on the equipment of the audience and the characteristics of the information systems used [19, 22, 23]. Teachers of the National Research University "BelGU" in the 2016–2017 academic year when testing the combined training faced this problem. To improve the quality of the organization of the educational process in the combined learning mode, in the 2018 academic year, standard configurations of multimedia equipment (in several versions) were approved for classrooms, depending on the number of seats (up to 30, from 30 to 70, more than 70). This equipment, depending on the type of audience, includes compact computers, interactive panels, input devices with touch displays, LCD panels, projectors and screens, stationary omnidirectional microphones, active directional microphones, ceiling microphones, speakers, web cameras with the ability to adjust the angle of inclination, etc. From 2018 to 2020, the university was equipped with 36 specialized classrooms.

The implementation of the interaction of the teacher and students in the classroom with remote participants of the educational process in the video conferencing mode is carried out using the BigBlueButton and Zoom services. Video conferences of these services are created by teachers in the online courses of the Pegasus e-learning system (based on the LMS Moodle) using standard plugins [24, 25] (Fig. 5). In the electronic educational environment of our university, each discipline of the curriculum corresponds to an online course of the Pegasus system with a mandatory element of the video conference. To facilitate the navigation of students, a quick transition to the required course is implemented in the electronic schedule.

Fig. 5. Video conferences in an online course

Figure 6 shows a scheme demonstrating this educational space for the implementation of blended learning. It provides remote students with the opportunity to be "present" in the classroom, allowing them not only to hear and see the instructor and all the materials presented, but also to ask questions and interact with the other members of the study group in the classroom.

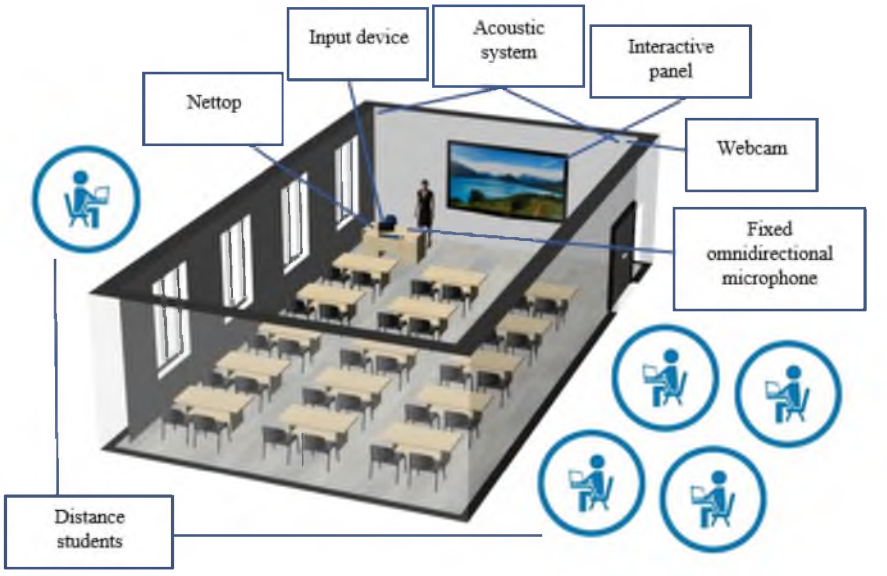

Fig. 6. The educational space of the classroom for combined learning

Another important requirement for ensuring a high-quality educational process implemented in the combined learning mode is the readiness of the teaching staff to conduct classes with real and virtual students [1, 21, 22, 26, 27]. An important function in the formation of the faculty of the National Research University "BelGU" readiness for the use of educational technologies in the information and educational environment, the ability to apply methods and tools for the educational process in the modes of combined and online learning, the ability to create digital multimedia teaching materials for the electronic environment was carried by the implementation of an additional training program "Digital Pedagogy: preparing teachers to work in the mode of combined and online learning" (authors-developers Belenko V. A., Klepikova A. G., Nemtsev S. N.). The experience gained by the university teachers in conducting classes in the distance learning mode during the pandemic allowed them to consolidate the digital competencies they received in a short time: actively use new educational technologies in their professional activities, skillfully build the learning process and receive feedback based on the interactive capabilities of the information and educational environment. Methodological seminars devoted to the organization of this approach, application of distance education technologies and online courses at the university contributed to the improvement of the educational process using blended learning. Teachers who attended the professional

development courses were able to successfully apply the acquired knowledge in their professional practice.

5 Conclusion

The paper deals with the use of a little-studied approach [20] in the organization of the educational process – combined learning (learning in hybrid virtual classrooms). The results of the study show, despite the fact that the use of combined training puts forward certain requirements for the educational environment of the university and for the competencies of the teaching staff, this method of organizing the educational process is quite promising. The experience of switching to distant learning during the pandemic proved that in a short time the educational environment of the university can be significantly rebuilt for the large-scale use of digital educational technologies [21]. During the year of isolation, the readiness of teachers of the Belgorod State National Research University to conduct classes in the combined learning mode has almost doubled. Currently, 91.7% of the teaching staff are ready to work in classrooms with heterogeneous study groups (some students are present in full-time mode, others are present synchronously in the classroom in video conferencing mode). In a short time, the university was able to rebuild the IT infrastructure to support the educational process.

The development of combined learning will be relevant even after the pandemic, since the society - taking into account the experience of large-scale distance learning – has developed a demand for increasing the level of flexibility and mobility of the educational process. There is an understanding of opportunities for expanding the boundaries of the educational process and integration into the world educational space. These opportunities are provided by the developed information and educational environment. Providing remote students with access to the real learning process in the combined learning mode, along with other approaches to the organization of the learning process (asynchronous learning in online courses), will allow the university to create an educational environment of variable access, providing the student with a choice of the form of participation in the learning process. The student can attend classes by coming to the classroom, connect to a real process with a "real presence effect", or study the discipline asynchronously in an online course environment.

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