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Monitoring Organization Educational Results of Students in the Blended Learning System

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Abstract

The success of teaching depends not only on a good presentation of the material, full-fledged independent work of students, but also on the correct accounting and verification of students' knowledge and skills. When we begin to consider distance learning as a method of training qualified specialists equivalent to traditional education, then the eternal problem of control of knowledge and skills for the education system may arise in the distance education system. In addition, the form of distance learning significantly complicates the full control of knowledge, due to the spacing in space, and sometimes in time of the student and teacher, the limited ability to observe the independent completion of tasks. The article presents the results and analysis of the work on the design, development and testing of the computer program of remote control knowledge, allowing to generate individual tasks of the current and intermediate control randomly from the formed bank of tasks and an automatic system of fixing and counting the academic rating of the student in the framework of the mastering the course. The structural elements of the program and their functionality are described. The influence of the use of the program on the optimization of the procedure for the distribution of control tasks, registration of the results of the tasks and on improving the quality of mastering the discipline is shown.

Keywords: control of educational results, blended learning format, knowledge control, education system, assessment tools.

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Introduction

Today, the defining task of universities is to train specialists who are able to constantly improve their knowledge and skills, who are able to quickly navigate the growing flow of information and make decisions in non-standard situations. The possibility of obtaining mass, accessible education is opened by the implementation of a remote form of education. However, shortcomings in the systemic organization of the remote learning process, the lack of clear regulated monitoring procedures often lead to a decrease in the quality of training of students, cause a negative attitude to distance education in general. The problem dictates the need for each university implementing a remote form of education to solve a set of tasks to create a system for assessing the quality of education. These tasks include quality planning, quality management, quality assurance, evaluation and quality control. Control is one of the most important components of the quality of learning system and is closely linked to concepts such as evaluation, verification, quality assurance.

The monitoring of the training is carried out throughout the student's studies at the university and should ensure the integrity of the structure of knowledge, contribute to the formation of motivation for learning, allow to track the individual achievements of each student.

In the system of distance learning control takes on a special significance, as the interaction of teachers and students takes place indirectly, in the conditions of the information environment of the university. In this regard, it is necessary to use such methods and forms of verification activities, which, on the one hand, would compensate for the lack of personal contact with the teacher, and on the other hand, would like represent a control procedure as a modern technological process that is attractive to the subjects.

Exercising control over the progress of the student's assigned tasks, the correct performance of the training operations, their compliance with the goals and objectives of the training, the teacher has the opportunity to determine the level of effectiveness of the entire model of the learning process, determine the effectiveness of the actions of each of its components, in order to timely make optimal adjustments. The quality of students' assimilation of educational material in the distance learning system, as well as in the traditional process, can be characterized by the levels of assimilation: 1) the level of representation; 2) Play level; 3) skill level; 4) Level of creativity. According to the forms, the traditional control system is formed by exams, credits, oral surveys (interviews), written control, abstracts, colloquiums, seminars, coursework, design works, observational journals, etc.

Purpose and objectives of the study

The purpose of the study is to conduct a pilot project of a computer program for remote control of knowledge that allows generating individual tasks for current and intermediate control in a random way from a generated bank of tasks and an automatic system for recording and calculating the academic rating of a student as part of mastering the course.

Literature review

One of the most effective models of modern education at a university is a blended learning model as a combination of traditional full-time education and elements of distance learning using modern information and communication technologies (ICT). The problems of using ICT tools in the subject area were studied by Boronenko, Kajsina, & Fedotova (2017), Gotskaja & Kotova (2014), Gotskaja, Zhuchkov, & Pustylnik (2013), Robert (2014), and Henner (2015). When developing a distance learning system, the recommendations presented in the works of Andreev & Soldatkin (2013), Andreev (1999), Andreev (2013), Kanavo (2007), Polat, Buharkina, & Moiseeva (2004), Khutorskoy (2021). According to the studies conducted by Sabirova, Shurygin, & Dulalaeva (2016), Leontyeva, & Rebrina (2018) and Gerashchenko, Gerashchenko, & Titova (2017), the control of learning outcomes should be carried out continuously in the learning process, ensuring the integrity of the structure of the competencies being formed, allowing you to track the individual achievements of each student and contribute to the formation of motivation to learn. In the conditions of active introduction of e-learning and distance learning technologies in the educational process of the university, the implementation of control in distance learning systems such as Moodle, Edx, LearningSpace, Microsoft Teams and others becomes relevant. The use of modern technologies implemented in distance learning systems can significantly optimize control measures and requires improving methods and technologies for the implementation of the educational process in universities. The authors also highlight the advantage of blended learning in comparison with traditional or only distance e-learning.

Methodology

The authors used such research methods as: theoretical analysis of the research problem based on the study of scientific and methodological literature, materials of conferences on the use of digital technologies in the knowledge control system, regulatory documents accompanying the process of training a physics teacher, study and generalization of pedagogical experience; observation, conversation, questioning.

The study was conducted on the basis of the Institute of Physics of Kazan Federal University among students of the 4th and 5th courses studying in the direction of "Pedagogical Education", profile "Physics and Mathematics". The participation was on a voluntary basis. The study covered 52 students, 25 of whom were in experimental group and 27 were control group. Students of the experimental group took part in the approbation of computer programs developed by the authors, during which the process of implementation of developments was monitored. Conversations were held with the participants of the approbation about the advantages and disadvantages of the implemented developments. At the final stage of approbation, a questionnaire and statistical analysis of the performance of students of the experimental and control groups was carried out.

Results

The educational process for the implementation of educational training programs in all areas during the pandemic was transferred to a distance form and was carried out on various online learning platforms. At Kazan Federal University, Microsoft Teams has become such a platform. All stages of the learning process, including current and final control, were organized on this platform.

To organize the current and intermediate control of the assimilation of the discipline "Modern quantum physics in education" in distance and blended learning, the authors have designed and developed a computer system for monitoring learning outcomes "Control", which consists of two programs:

- 1) a task distribution program,
- 2) a program for registering the results of tasks fulfillment.

The first program allows you to distribute individual tasks of independent, control, examination and credit works at the choice of students randomly assigned task numbers. After the student selects the task number, the contents of the task appear on the monitor screen. The control system fixes assignment of a task to a given student and excludes this task from the list for selecting other students. Figure 1 shows a fragment of the execution of the program for choosing an exam ticket and fixing the ticket number for a specific student. In this figure, you can see that there are no numbers of tickets selected by students in the field of ticket numbers. The slots of these tickets are empty and the program excludes the possibility of re-selection of these tasks by other students.

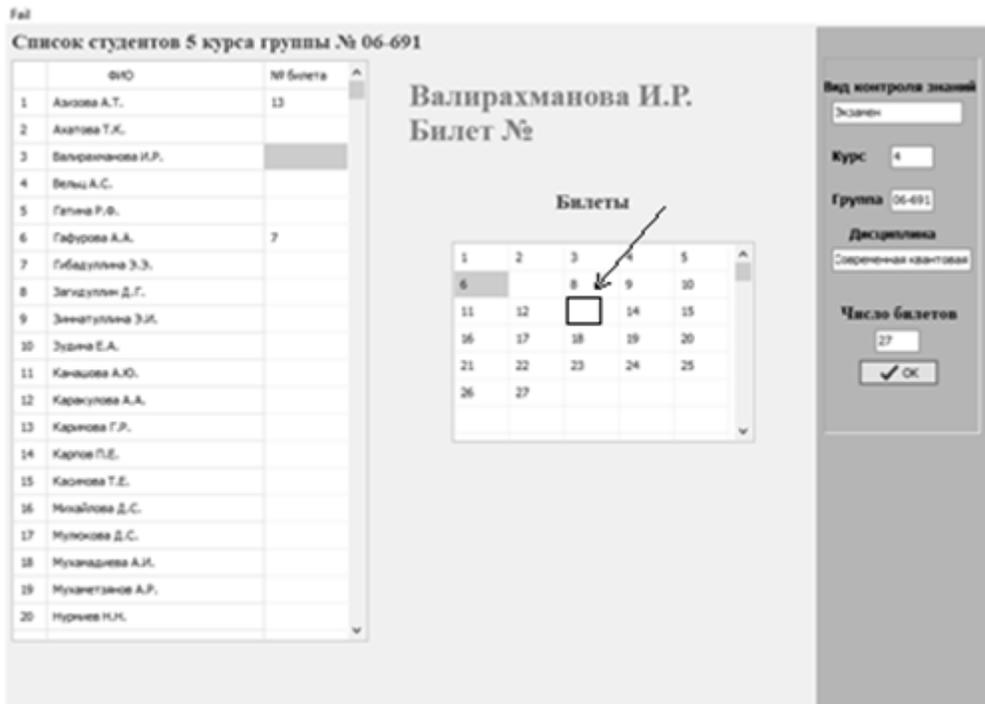


Figure 1. A task distribution program window

Figure 2 shows the view of the presentation of the tasks of the exam ticket, which automatically opens after the student selects the ticket number.



Figure 2. View of the tasks of the examination ticket

After the distribution of the tasks of the ongoing or intermediate control, the students perform the received tasks within the allotted time for this form of control. In this case, the teacher conducts video surveillance of the independence of assignments. After the expiration of the time, students have the opportunity to attach files with the results of completed practical tasks and orally answer theoretical questions publicly or in a separate channel. The teacher evaluates the answers and completed tasks according to the evaluation criteria of this form of control and records the results in points in the program for registering the results of assignments. The program calculates the amount of points for all tasks and translates it into a 5-point grading scale in accordance with the regulation on the point-rating system. Figure 3 shows a fragment of the program for registering the results of assignments, where the "Points" column shows the amount of points scored by students for all forms of monitoring during the semester. In the column "Additional", additional points are set that students can receive for the implementation of other types of activities. Columns 1,2,3 indicate the points for the corresponding tasks of the ticket. The number of columns can be changed according to the number of tasks in the ticket.

Fail

	ФИО	Баллы	Доп.	1	2	3	Сумма	Оценк
1	Азиева А.Р.	25	12	10	12	5	64	хорош.
2	Алексеева А.Ю.	28	20	12	13	18	91	отл.
3	Андреева С.С.	0	0	0	0	0	0	
4	Афанасьева А.Б.	0	0	0	0	0	0	
5	Ахметгалеева Д.Ф.	0	0	0	0	0	0	
6	Большакова А.Ю.	0	0	0	0	0	0	
7	Галиметова Е.А.	26	18	11	13	12	80	хор.
8	Гудатгулова А.Ф.	0	0	0	0	0	0	
9	Иванова А.А.	0	0	0	0	0	0	
10	Климова Л.А.	0	0	0	0	0	0	
11	Курбанова А.Н.	0	0	0	0	0	0	
12	Мельникова Е.С.	18	10	6	5	4	43	неуд.
13	Мухаметова И.И.	0	0	0	0	0	0	
14	Мухаметова И.И.	0	0	0	0	0	0	
15	Рашидгулова И.А.	0	0	0	0	0	0	
16	Сафинуллина З.Р.	0	0	0	0	0	0	
17	Соловьева В.Д.	0	0	0	0	0	0	
18	Тимонова А.П.	0	0	0	0	0	0	
19	Хаббуллина А.А.	0	0	0	0	0	0	

Доп=1+2+3

OK

Оценка 1,2,3

Оценка

Figure 3. Window of the program for registering the results of tasks execution

After the program "Control" calculates the final score of the student for completing the tasks of intermediate and current control and transferring it to a five-point scale, the teacher fills in the bill of intermediate control.

Computer distribution of tasks and automated scoring allows the teacher to optimize the procedure for conducting intermediate control and eliminates the occurrence of random errors when filling in the final scores.

The computer program "Control" developed by the authors was tested during intermediate control in remote form in the discipline "Modern quantum physics in education" among 4th year students of the Institute of Physics of Kazan Federal University, students in the direction "Pedagogical education", profile "Physics and Mathematics". After the approbation, the students answered the questions of the questionnaire about their attitude to the computer program for the distribution of tasks and the program for registering the results of the tasks used in the organization of intermediate control. 25 students took part in approbation and questioning. The respondents were asked the following questions:

Question 1. Have you had to take an exam or test in a school subject in a distance form? 100% of the respondents answered this question in the affirmative.

Question 2. In your opinion, in what form is it more comfortable to take the exam (test)? Answering this question, 96% of the respondents chose the remote form of intermediate control.

Question 3. In your opinion, the most objective assessment of the results of the examination (credit) tasks occurs during full-time or remote intermediate control of learning outcomes? When answering this question, opinions were divided: 52% of the respondents believe that an objective assessment of the results of the examination (test) tasks takes place with face-to-face control, 48%, which is remote control.

Question 4. In your opinion, what is the best way to select an examination (test) task for remote intermediate control of learning outcomes:

- a. appointed by the teacher
- b. a random number generator is used
- c. self-selection of a student according to the proposed ticket numbers
- d. suggest your version

32% of the interviewed respondents chose the item "b. a random number generator is used", 68% of the surveyed respondents chose "c. self-selection of the student according to the offered ticket numbers". Answer options under points a. and Mr. was not chosen by any of the respondents.

Question 5. Evaluate on a 10-point scale the degree of manifestation of the criteria for the examination procedure in the discipline "Modern quantum physics in education" using a computer program (1 - the minimum degree of manifestation, 10 - the maximum degree of manifestation):

- a. transparency of the procedure for the distribution of examination tasks
- b. the degree of organization of the examination procedure
- c. objectivity in assessing the results of the examination tasks

Evaluating on a 10-point scale the degree of manifestation of the criterion "a. transparency of the procedure for the distribution of examination tasks", 88% noted the maximum degree of manifestation of the criterion, 8% gave 9 points and 4% - 8 points. When evaluating the criterion "b. the degree of organization of the examination procedure" 72% of the respondents noted the maximum degree of manifestation of the criterion, 8% gave 9 points, 12% - 8 points and 8% - 7 points. The criterion "c. objectivity in assessing the results of the examination tasks" 68% rated the maximum 10 points, 20% rated 9 points, 4% 8 points, 4% 7 points and 4% 4 points.

Question 6. How do you feel about the use of a computer program for organizing a remote examination in the discipline "Modern quantum physics in education"? Answering this question, 4% of the respondents reacted negatively to the use of a computer program for organizing remote intermediate control. 24% of the interviewed respondents regarded the use of the computer program "Control" as a forced measure, without expressing either a positive or a negative attitude. 72% of the respondents expressed a positive attitude to the use of a computer program for organizing the remote examination, noting that "this is an excellent option as it allows you to speed up the process of distributing tickets", "it is convenient that the student is alone in the room, there are no interfering factors, you can use the program to easily choose ticket, see the ticket task immediately on the screen, the total score is quickly calculated and the final score is displayed."

Question 7. Please, express your suggestions and recommendations for improving the efficiency of using a computer program for organizing remote monitoring of learning outcomes.

According to the answers of the respondents, we can conclude that “the current option seems to be the most successful” and the recommendations mainly concern the procedure for organizing responses to the tasks received: “wait a long time for your turn to be answered”. The problem of large time expenditures in the case of an individual oral answer to the tasks of intermediate control tickets concerns not only the remote, but also the face-to-face form of the control. This problem can be partially solved by using other forms of control (testing, group cases, written responses to assignments).

Thus, the use of intermediate control in a distance form in the discipline "Modern quantum physics in education" received of students positive feedback and showed the possibility of reducing the time spent on organizing the procedure for distributing intermediate control tasks, registering the results of tasks and determining the final score with transfer to assessment on a five-point scale.

The analysis of the results of the questionnaire survey and the results of the intermediate control allowed the authors to assume that the use of the Control program also influenced the quality of the learning outcomes in the discipline “Modern Quantum Physics in Education”. To confirm the hypothesis put forward, a comparative analysis of the learning outcomes of students who studied the discipline and passed intermediate control in a distance form with and without the use of the Control program was carried out. To exclude subjectivity in the assessment, the results of students who had undergone training and the intermediate control procedure from the same teacher were considered. As a control group, a group of 5th year students of the Institute of Physics of Kazan Federal University enrolled in the direction "Pedagogical Education", profile "Physics and Mathematics" in the amount of 27 students studying the discipline "Modern Quantum Physics in Education" in the 4th year was selected. To establish statistical differences between the two samples of groups of subjects, a T-test was carried out to determine the Student's criterion for the academic rating of students in the groups. Based on the results of determining the Student's t-test, it was determined that there were no differences in the groups of subjects.

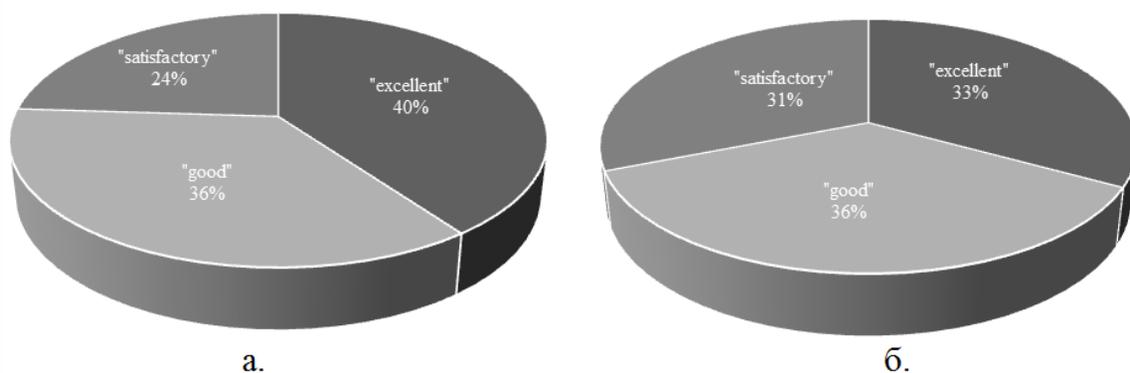


Figure 4. Diagrams of the distribution of estimates of intermediate control in the discipline "Modern quantum physics in education" in the experimental (a.) and control (b.) groups

Analysis of the results of intermediate control in the discipline "Modern quantum physics in education" revealed significant differences in the groups of subjects. The average score of the exam results of the experimental group of subjects was 76.4, the average score of the control group of subjects was 72.8 points. The distribution of students' grades in these groups by categories "excellent", "good" and "satisfactory" is shown in Figure 4. Diagram a. Figure 4 shows that in the experimental group 40% of students have mastered the discipline for the mark "excellent", 36% for the mark "good", 24% for the mark "satisfactory". Diagram b. Figure 4 shows that in the control group 33% of students have mastered the discipline for the mark "excellent", 36% for the mark "good", 31% for the mark "satisfactory". Grades on a five-point system are calculated in accordance with the Regulations on the point-rating system of the Kazan Federal University. The mark "excellent" is given if, when mastering the discipline, the student scored from 86 to 100 points, "good" if received from 71 to 85 points, "satisfactory" - from 56 to 70 points.

From the comparison of the diagrams, it follows that the "excellent" grade in the experimental group was received by a greater percentage of students than in the control group, the "good" grade was the same percentage of students, and the "satisfactory" grade in the experimental group had a smaller proportion of students than in the control group.

Let us consider the distribution of average scores in the categories "excellent", "good" and "satisfactory" in the experimental and control groups. The distribution results are shown in Figure 5 in the form of a diagram, which clearly shows that the average score for all categories in the experimental group is higher than in the control group.

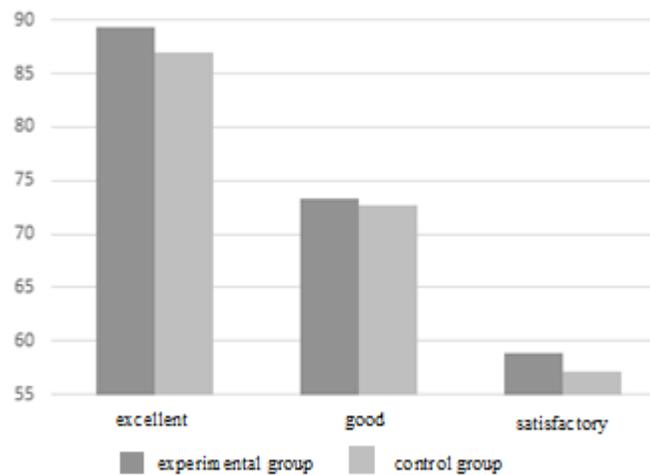


Figure 5. Distribution of mean scores by category in the experimental and control groups

The above analysis shows that the quality of mastering the discipline "Modern quantum physics in education" in the experimental group is higher than in the control group. Differences in the conditions of mastering the discipline in groups lies only in the use of a computer system for monitoring learning outcomes, which allows the authors to conclude that the quality of mastering the developed program "Control" has a positive effect.

Discussion

Most studies on the use of distance or blended learning in the training of future teachers consider the use of tests to be a major type of control. For example, in the works of Gerashchenko et al. (2017) and Sabirova et al. (2016) the results of studies describing the application of the test system of knowledge control and its impact on the provision of motivation, self-development, the formation of certain qualities and competencies of students are given. In studies by Gotskaja et al. (2013), Vodenko, Chernyh, & Borovaya (2020), Boronenko et al. (2017) the potential of using active and interactive methods of teaching and controlling the assimilation of material in distance learning are revealed. In contrast to these works, the authors of this study paid more attention to the organization of the process of conducting intermediate certification in the form of an exam in a remote format. The main emphasis is placed on the possibility of using computer programs developed by the authors to distribute individual tasks to students and automated scoring for completed tasks. In the course of the study conducted by the authors, the influence of the use of developed computer programs on the academic performance and quality of learning outcomes in the academic discipline "Modern quantum physics in education" was revealed.

Conclusion

The research results can be used in the implementation of the current and intermediate control of students' knowledge in distance and blended learning. The authors believe that the developed computer program will significantly reduce the time spent on remote monitoring of learning outcomes and simplify the monitoring procedure. The use of this program can have an impact on improving the quality of mastering the discipline.

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