Transformation of the Digital Transformation Tasks of Education

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Abstract. The possibilities of implementing the ideas of digital transformation of education, formulated in a number of scientific works and programs are analyzed in the article. From a comparison of the stated goals of digitalization and the conditions for their achievement, it is concluded that it is premature to set them at the present time. At the same time, there are two tasks that are relevant for Russian educational organizations of all levels - the creation of a universal network communication system for educational purposes and the use of multimedia testing. The need for a domestic educational communication system clearly manifested itself in 2020 in connection with the massive use of distance learning at all levels of education.

The need to use multimedia objects in test computer control is justified by a noticeable expansion of the scope of its use: primary school, language disciplines, disciplines of the aesthetic cycle, medicine, computer science, etc. Two main technological approaches to creating multimedia tests are discussed: using specialized test systems and using interactive video. The approaches are illustrated with examples from the discipline "Computer mathematics".

The solution to both problems is possible at the current level of development of information technologies and systems. The developments must be financed by the Ministry of Education and Science and the Ministry of Education and donated to all educational organizations in Russia. Thus, we are talking about reorienting the tasks of digital transformation to the needs of educational practice.

Keywords: Digitalization of Education, Educational Communication System, Multimedia Testing, Interactive Video, Computer Mathematics.

1 Introduction

The ideologist of digitalization of education in Russia is the Higher School of Economics. Its specialists examined various aspects of this process in great detail, for example, in the report "12 solutions for a new school" (2018 г.) [1]. In another report (September 2019) "Problems and prospects of digital transformation of education in Russia and China" its goal is defined as "the achievement of the necessary educational results by each student through personalization of the educational process based on the use of the growing potential of DT, including the use of artificial intelligence methods, virtual reality facilities; development of digital educational environment in

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educational institutions; providing public broadband Internet access, working with big data" [2].

We are not going to analyze what the authors mean by "necessary educational results", but we are going to focus on the means of achievement, which, by definition, should include the use of the most modern information technologies - artificial intelligence, virtual and augmented reality, big data, blockchain, and etc. The use of these tools creates the need to fulfill a number of conditions:

- creation of a modern technological infrastructure in educational institutions, implying the equipment with the necessary computer equipment and access to fast networks;
- creation of an educational environment that includes educational content and educational process management tools;
- development of methods for applying the listed modern technologies in solving educational problems (what educational tasks can be significantly improved, for example, the use of artificial intelligence at the level of a university or school, and to what extent is this justified from the pedagogical, economic, psychological and ethical point of view?);
- ensuring the readiness of teaching staff to use modern technologies.
- the assessment of the realistic fulfillment of these conditions in schools and universities in Russia allows us to conclude:
- the state of the technological infrastructure of educational institutions is mainly determined by state funding, which was previously insufficient to create the required technical level in most universities and schools. A sad consequence of the economic problems associated with the pandemic was the proposal of the Ministry of Finance of Russia in August 2020 to reduce funding for the state programs "Healthcare Development" and "Education Development" by about 10% in 2021 and 2022; thus, universities cannot count on a noticeable improvement in the material and technical base and, accordingly, the use of advanced technological solutions in the near future;
- if we consider the areas of development, for example, in the field of artificial intelligence (knowledge representation, machine learning, intelligent robots, cognitive modeling, etc.), then they do not have tasks related to mass education; the same can be said about other modern information technologies being developed above; on the other hand, the tasks solved by educational organizations do not require the use of such technologies; thus, as long as the linking of new technologies to education is speculative or distant, they are not required for educational practice.

This analysis was made not to deny the need to digitalize education, but to indicate a different approach to identifying its priorities. It is necessary to start not from beautiful (but impracticable) slogans and someone's commercial interests, but from the needs of educational institutions. As examples, the authors focus on two similar tasks that are currently relevant for all schools and universities in Russia, the solution of which is possible at the existing level of development of information technology, on the one hand, and not requiring significant financial investments, on the other.

2 Objective 1. Educational communication system

In connection with the forced mass appeal of education to distance technologies and, in particular, to interactive technologies, the absence of accessible communication systems oriented towards application in the educational process was revealed. Teachers are forced to use many different systems: Zoom, Microsoft Teams, Google Meet, Mirapolis, Discord, Skype, etc. However, firstly, these are not specialized educational platforms, but universal communication services, which do not provide for the solution of many educational tasks (keeping a progress journal, polls, access to the listener's screen, recording, file exchange, etc.); secondly, most of these systems are commercial - available free versions have limitations on the duration of work (Zoom), the number of listeners (Discord, Skype). Universities do not provide for the acquisition of official licenses, as a result, teachers are forced to independently choose the most convenient system for themselves, and the range of such systems is wide. This, in turn, forces students to create multiple accounts and work in different systems. At the same time, it is impossible for teachers to carry out a unified preparation for the use of services and develop unified organizational and methodological approaches.

Thus, it seems extremely important for Russian education to have a universal communication system focused on solving educational problems and providing both on-line (conducting interactive classes) and off-line – saving and accessing educational content, giving-receiving-evaluating educational assignments, keeping a progress journal, communication of participants at the chat and forum level, interaction with mobile devices. The system should be developed by order and with funding from the Ministry of Education and Science of the Russian Federation and the Ministry of Education of the Russian Federation, and free for schools and universities. It will ensure:

- universality and continuity between different levels of education;
- unity of approaches to building the educational environment, content development;
- uniformity of teacher training;
- the issue of using systems with personal data located all over Russia will be withdrawn.

The development of such a system is quite possible within the framework of existing technologies, and it will provide a real involvement of schools in the digitalization of education.

3 Task 2. Multimedia testing

3.1 Statement of the problem

Test checking of knowledge is one of the main forms of control, which was further developed due to the possibility of using a computer in the testing procedure. At the same time, the computer assumes a number of functions of a teacher of an algorithmic nature, performing the storage of the task base, generating a test version from it and

presenting it to the student, receiving answers, comparing them with reference values and determining correctness, scoring according to established criteria and demonstrating the results to the testee. Thus, the test computer technology provides large-scale participation and control operational efficiency, which, in turn, creates the prerequisite for their frequent use, positively affecting the rhythm of students' academic work. There are many works devoted to the use of computer tests in the educational process. The authors analyze the advantages and disadvantages of this form of control, discuss the possibilities of its use in the distance learning [3-8]. In particular, the following advantages of computer testing stand out:

- automation of the survey procedure, which provides the possibility of testing without the direct involvement of the teacher; the possibility of organizing self-control of students and distant (remote) checking should be considered as a private manifestation of this quality;
- expanding the range of responses of the testee – besides “mark” and “write” in the blank testing, additional mouse manipulations are involved: mark with a click, specify an area, move an object on the screen - this opens up fundamentally new possibilities for constructing tasks (for example, constructing a final image (phrases) on the screen from individual blanks);
- efficiency of evaluating the response and the conclusion of the result immediately after testing;
- the possibility of automated mathematical and statistical processing of results in order to generate output forms of performance, as well as assess the quality of the test, which, among other things, eliminates the need for the teacher to master and implement computational algorithms;
- higher security of measuring materials, since a non-variant (accepted in the blank testing) approach to building an individual test is used, which leads to the possibility of borrowing answers between students, but a facet one, which allows you to generate an almost unlimited number of individual options [7];
- the possibility to personalize current control through the use of a customizable rating scale and adaptive testing algorithms.

Due to these advantages, computer testing has been used in the educational process for more than 30 years since the first domestic computers appeared at the school (KUVT-86, Corvette, Yamaha). In the meantime, the capabilities of computer technology in terms of screen display of information have grown tremendously, however, this has almost had no effect on the presentation of test tasks - even in the most modern testing systems and distance learning platforms (including the most famous), mainly alphanumeric tests, less often - tests, containing static graphics are used. But an alphanumeric representation is not at all indispensable quality of a computer testing. Modern computers are focused on the processing of multimedia information. The use of multimedia in education is considered mainly as a means of increasing the visibility and interactivity of the educational process [6, 9]. In educational practice, tests that include multimedia objects — animation, sound, and video — are not applied. At the same time, they would significantly expand the scope of the use of test technologies: elementary school and language disciplines, in which it is possible to

provide a vocal formulation of the task; disciplines of the aesthetic cycle, medicine, etc., in which video and sound fragments could be successfully applied; mathematics and computer science with the ability to demonstrate screencasts, etc. This article is devoted to the discussion of technological possibilities of including multimedia objects in the testing and polling procedure. These possibilities are well described in the book by I. Cheng et al [10].

3.2 Problem Solving Approaches

The authors' experience allows to distinguish two approaches to solving the indicated problem of creating multimedia test control materials.

The first is to use specialized test control systems that support the inclusion of multimedia objects in the construction of test tasks. As an example, we can cite the domestic INDIGO system [11], which allows to perform testing control in a local or global network, and which has a number of other advantages. The disadvantages of the system include the fact that it uses flash technology to work with multimedia objects.

The second approach is to use interactive video. Various didactic possibilities of interactive video and technologies for its creation are described in the work of C. Benkada and L. Moccozet. However, they do not focus on testing [4]. If in test systems m/m objects are placed in test tasks, then in the interactive video the situation is the opposite - test questions (and polls) are included in the training video. During its viewing, the student is presented with questions or comments regarding what he saw; while the fragment is paused and resumed after answering the question. Examples of such applications include PlayPosit [2] and Learnis [12].

Of practical interest is the popular LearningApps application, which, being freely distributed, allows you to create both multimedia tests and interactive video [13]. Separately, those and other LearningApps features lose to the above systems, however, this is compensated by the free use, the presence of the Russian version, a simple and intuitive interface, the ability to upload products to SCORM format or viewed from mobile devices.

The didactic features of each of the approaches can be specified.

Multimedia testing system:

- provides all types of control: classroom - training, formative, final; extracurricular - training, final;
- requires a large number of short multimedia fragments to ensure the variability of test tasks;
- in the test, tasks with m / m objects are used along with “ordinary” ones (alphanumeric or with static graphics);
- testing procedure is carried out by means of a test shim.

Interactive video:

- used for educational control (classroom or extracurricular);
- based, as a rule, on one video fragment of medium duration (5-15 minutes);

- a relatively small number of possible types of tasks included in the video clip;
- product creation is carried out in a specialized application; presentation is possible in other environments and, in particular, on a mobile device.

Thus, approaches in a certain way complement each other - their skillful combination can significantly increase the interactivity of the learning process.

3.3 Field of application example

The stated approaches were tested by the authors in the process of teaching the discipline "Computer Mathematics".

Interesting classes of problems, the algorithms for solving which can be advantageously illustrated, are problems that include the analysis of mathematical models, in particular the solution of problems with parameters. At the same time, it is convenient to conduct dynamic visualization of the solution using the animation tools that are available in the packages Mathcad, Mathematica, Maple [14]. The toolkit of packages allows you to view video using the built-in players, however, there is always the possibility of capturing the screen and recording a video clip in the form of a screencast with teacher comments. The resulting screencast can be used to prepare an interactive video.

As an example, the solution of the task 4.38 from the task book "Tasks with Parameters" by V. V. Amelkina and V. L. Rabtsevich is given [15]. It is necessary to analyze the influence of the parameter a on the number of roots of the equation

$$|3x + 3| = ax^2 + 4$$

The solution is conveniently implemented by the method of graphical modeling in the Mathematica package, making parameter a changeable and using the Manipulate function - this will allow you to animate the representation of the right side of the equation on the graph with respect to the fixed graph of the left side. Interactive video with test tasks included in it is implemented in the LearningApps environment and is available at https://learningapps.org/display?v=pfi2dq28n20; the final test task, which allows to evaluate the degree of student understanding of the results of dynamic modeling, is shown in Fig. 1.

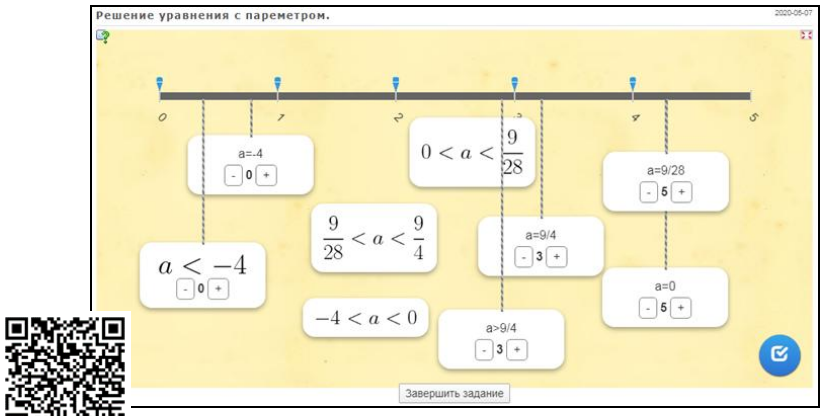

Fig. 1. Test task from the interactive video "Roots of the equation"

Multimedia test tasks were implemented in the INDIGO system. Below are screenshots of such tasks (Fig. 2, 3).

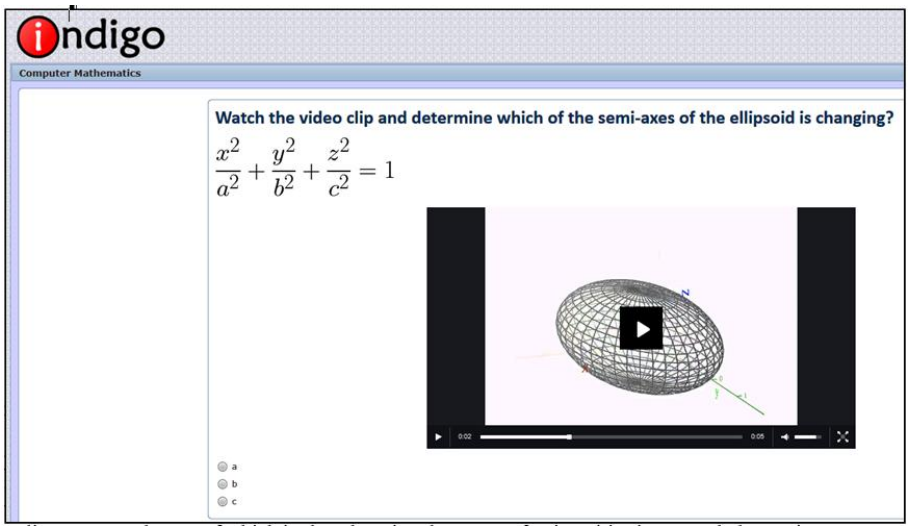

Fig. 2. Multimedia test tasks in the INDIGO system

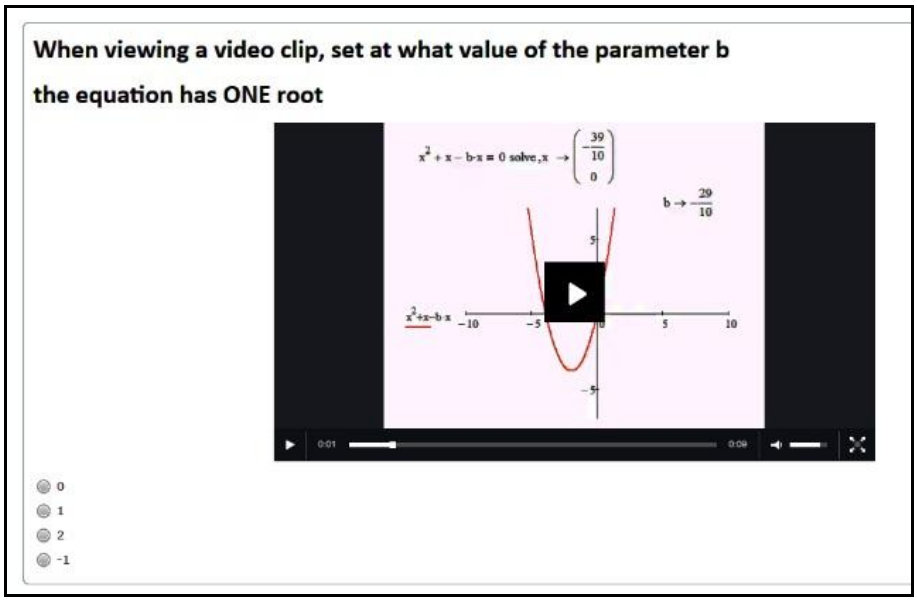

Fig. 3. Multimedia test tasks in the INDIGO system

The discussion and practical testing of the ideas presented showed that the use of multimedia testing is quite technologically accessible and, therefore, its non-use in the educational process can be justified only by the conservatism of platform developers, on the one hand, and tests, on the other. From our point of view, the use of interactive computer tests should become as common as the use of multimedia to increase visibility. However, test systems on platforms for hosting online courses, the use of which in the educational process of universities is now becoming mandatory, do not yet provide for such an opportunity, which imposes thematic and content restrictions on the courses being created.

Thus, we have designated the 2nd task of digitalization, which may well be solved by existing technologies or simply purchased at the level of ministries (for example, INDIGO) and transferred to educational organizations.

In this article, the authors wanted to show that we should free ourselves from the illusions and captivity of beautiful words contained in the Programs for the revolutionary transformation of education. We can move on to pedagogically justified planned activity in the right direction (even with the available scarce technical means). At the same time, without diminishing the importance of work on the development of modern technologies - artificial intelligence, virtual reality, big data, etc. – the authors wanted to note that from the point of view of the problems of schools and universities practice, it is undoubtedly more urgent to create a national educational communication system, to develop a networked computer multimedia testing system (possibly with proctoring elements) of an accessible and convenient interactive video system with the ability to post content in domestic clouds storage.

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