

Assessment of the Quality of Distance Learning during the Period of COVID-19

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Abstract: This paper discusses the issues of building the educational process in the distance learning system, the associated difficulties and ways to overcome them. The main topic of the study is the methodology for assessing the quality of knowledge of students through test control during the entire distance educational process. The authors set out both the necessary requirements for test items that ensure the quality of assessment of students' knowledge, and various formats of testing in the educational process, their purpose and ease of use in distance learning. Particular attention is paid to the effectiveness of the testing systems used, the simplicity of the formation of the test task, the tools for replenishing the test base, automation of both the testing session and the announcement and saving of its results. The authors describe the different formats of the content and organization of the test control, as well as the learning elements introduced into the test control. As an example, several testing systems developed by the authors are demonstrated and are successfully used in the distance learning process.

1 INTRODUCTION

During the pandemic, especially dramatic changes took place in the field of education. The need to conduct classes in a distance format posed a difficult task for teachers:

- provide the educational process with electronic educational materials available via the Internet in a short time;
- think over the format of the distance learning;
- to acquire the equipment necessary for distance learning.

An equally difficult task faced the leadership of the Russian universities – to quickly deploy educational platforms for distance learning. Despite the fact that many Russian universities were not ready for this, most of them, in particular, the St. Petersburg State Maritime Technical University (SPbGMTU) quite quickly created portals in the form of distance learning centers, providing a convenient form of interactive communication between students and

teachers, and also purchased platforms for on-line learning: Zoom, Webex, and etc.

The same is true for teachers. Never before the period of the pandemic did university professors improve their qualifications in the field of using computer technologies so massively and intensively. Moreover, during the student holidays, many universities, in particular, the SPbGMTU, conducted advanced training courses in order to expand the competencies of teachers in the use of modern information technologies and software in the distance educational process.

It is clear that Russia has made a real leap forward in digital educational technologies. “Noone in the world has done more to digitalize education than the coronavirus” (Demakov, 2020).

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2 NEW FORMAT OF THE EDUCATIONAL PROCESS

2.1 Using Online Platforms

Surprisingly, university professors, even the most active opponents of computer technologies, promptly prepared the electronic educational materials necessary for studying the discipline being taught, developed a method of conducting distance learning that was convenient for them and adapted to the characteristics of the course being studied, and bought the necessary equipment for this: graphic tablets, web cameras, and etc. Despite the fact that in the universities of the Russian Federation, classes are held both remotely and in a mixed form, lectures are delivered remotely. The distance form of lecturing was especially difficult for teachers of physical and mathematical disciplines, whose educational material contains a large number of formulas and figures. One of the most effective ways to conduct such exercises is “working with two screens”. If a lecture is being held, then the prepared material of this lecture is open on one screen, and the other is filled in "in real time", i.e. the necessary additions and explanations, answers to questions arising from the listeners, etc. are written on it.

If a practical lesson is held in a remote format (Fig. 1), then the theoretical material that is used in solving the problem is displayed on the left screen, and on the right screen, again, the solution itself is

demonstrated in real time. Wherein, students can even see the set and editing of formulas. Teachers who are not proficient in fast typing and editing formulas use graphic tablets and just writing on a piece of paper that is displayed on the screen through a webcam.

2.2 Form of Dialogue with Students

Dialogue between the teacher and the students, i.e. checking homework, tests, etc. with distance learning, as a rule, it takes place via e-mail.

This significantly increases the load on the teacher, since with this format of training, it is necessary not only to point out the mistakes made in the work, but also to give a detailed explanation, indicate the way to correct them, give a link to the corresponding theoretical material and to the demonstrated solution of similar problems.

Surprisingly, it turned out that this method of exchange gives the teacher a broader and more accurate idea of the level of knowledge and performance of both the entire study group and the individual student.

Moreover, almost daily correspondence with the teacher, in which the student receives a detailed explanation of his/her mistakes and shortcomings, contributes to their greater involvement in the educational process and increases the motivation for learning, in comparison with full-time training.

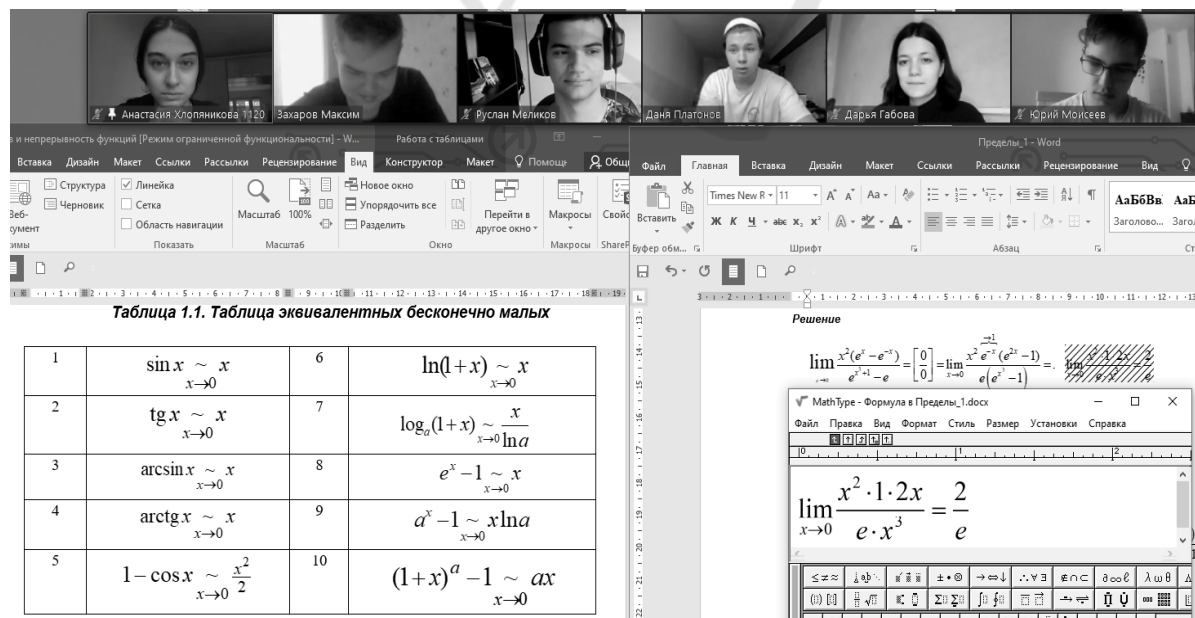


Figure 1: Conducting a lesson through the on-line Zoom platform.

2.3 Assessment of the Education Quality

One of the ways to assess the quality of education, in particular mathematics education, is the monitoring of the assimilation of the studied material at all stages of the educational process, carried out in the form of test control. If the educational process takes place in a distance form or in a mixed (part-time) form, then test control is its necessary attribute.

Test control in distance learning is carried out both to assess the educational activities of students and to arrange and manage the educational process (Verbickij, 2013). Moreover, given the correct content of test items, testing can also be an element of learning.

The benefits of knowledge control in the form of testing include:

- obtaining an objective assessment of knowledge;
- participation in a testing session for the entire study group;
- obtaining information about the level of knowledge of students within a few minutes;
- formation of students' skills in solving problems;
- increasing the motivation of students to systematically prepare for classes.

2.3.1 Test Requirements

Considering testing as a tool for assessing students' knowledge, it is possible to formulate the necessary requirements for the test:

1. Differentiating ability of the test – the division of the tested according to the level of competence.
2. Test Validity – Test items should cover all aspects of the topic being tested and be consistent with the competencies they are assessing.
3. Reliability of the test – the results shall not be random, which is determined by both the quality of the test tasks and the comfort of the conditions of its conduct.

If at the same time to take care that the teacher does not spend too much time on formation of test tasks and on their assessment, then it is necessary to ensure the automation of the formation of tests from the available test base and the output of the test session results both for each test taker and for the entire study group.

Compliance of the test with all the mentioned criteria is checked on the basis of repeated testing sessions in different academic groups. The difficulty level of the test is also experimentally verified. Too simple (correctly performed by the overwhelming majority or all subjects) or too complex test (the

overwhelming majority of subjects or all of them fail) is useless, since it does not solve the problem of assessing the level of assimilation of the studied material. Since the tests, as a rule, are formed from the base (pool) of test items, structured by discipline topics and by the level of complexity, “manually” or through the program, then too simple or too complex tasks shall be excluded from it or significantly reworked.

Sometimes the test turns out to be "difficult" due to the small amount of time allotted for it. In this case, you need to increase the time for passing the test. It is even better not to limit the time of the testing session, but to include the time spent by the subjects in the rating, which determines the given grade. This format of test control is also preferable because it creates a more comfortable environment in the audience (at an on-line conference or in a computer room), since it gives the subjects an opportunity to show their knowledge without fear that the session is about to end.

If the tests are generated programmatically from a database of test items, structured not only by the topics of the studied material, but also by the level of complexity, then the implementation of the so-called adapted testing is possible. In this case, tests of different levels of complexity are formed, depending on the previous results of the test control.

As you know, there are two forms of tests: closed and open tests. Closed types of tests (multiple choice tests) involve choosing one or more answers from the proposed options or establishing the truth/falsity of the statements presented. Open forms of tests involve students' answers to the essence of the task, the wording of which ensures that there is only one correct answer. This form of test items is more difficult for the test subject, since in closed tests it is sometimes possible to choose the correct answer based not on knowledge, but on intuition, or on the basis of an analysis of deliberately unrealistic results, or simply guessing. Open test assignments are more valuable for the teacher, however, the implementation of testing systems in the form of a program focused on open tests is associated with great difficulties: the form of recording the answer is strictly regulated and any deviation from it when checking the results of a testing session programmatically can be perceived as an error.

2.3.2 Teaching Function of Tests

Testing that accompanies the student throughout the educational process, with a methodologically competent organization, can also be of a teaching nature. “Tests don't just measure learning – they promote learning” (Butler, 2018). Test control contributes to the formation of problem-solving skills

if the subjects get the opportunity to find out the questions in which mistakes are made, to realize them and pass the test again. This is demonstrated by examples in (Author, 2019), (Kunturova, 2019), and in (Author, 2017), a test control system adapted for small screens is described, i.e. allowing to conduct a testing session in a regular classroom using smartphones.

Numerous studies have shown that closed tests (multiple choice tests) are educational in nature no less than open ones, since they not only improve the memorization of correct information, but also make it easier to remember information related to incorrect alternatives (Little, 2012). Multiple choice tests (closed tests) are very effective if the number of answer options contains a corresponding number of plausible incorrect alternatives. Wherein, studies have shown that test tasks in which none of the listed answer options is correct are “distracting” in nature and do not solve the goal set for using the testing technology.

Similarly, tests in math disciplines are useless if multiple answers are correct. Although, tests in the humanities, it is sometimes advisable to form tests with several correct answer options, differing in completeness, generalization and level of understanding, as described in (Little, 2012).

2.3.3 Regular Test Management Function

The main function of testing is not to control knowledge, but to assess its quality, on the basis of which the educational process is controlled by the teacher and students' self-government. Regular (ongoing) testing allows the teacher to manage the learning process, i.e. correct it in accordance with the obtained test results:

- it is possible to consider again in more detail some sections of the passed topic;
- adaptively, depending on the results for the whole group, present further material;
- refer some sections of the educational material with a shortage of time and a sufficiently high level of assimilation of the material of the educational group for independent study, and etc.

In more detail, the issues of management of the educational process are investigated in the paper (Author, 2020).

2.3.4 Test Control Format

Modern computer technologies allow testing sessions in three directions:

- - as a personal monitoring of students through the testing system;

- - to carry out control testing in the mode off line in the "paper version";
- - to conduct control testing online using electronic means.

Personal monitoring of students, as a rule, is carried out through a testing program built into an electronic training course (ETC) designed for self-study. The need to include an element of personal monitoring in the ETC is discussed in the paper (Petrovic-Dziedz, 2019). "The typical student usually does not close the textbook after studying, but voluntarily answers the questions posed at the end of each chapter." Studies show that he/she conscientiously participates in self-tests in order to know about the state of his/her knowledge level." If testing is carried out solely to assess the knowledge gained by the subjects, then there is a temptation to look for alternative ways in order to earn a good grade. An effective personal monitoring system built into the ETC is demonstrated by examples in (Author, 2014, 2017, 2019).

Off line mode testing system does not require a computer class, it can be carried out in any auditorium or online through the conference. The advantage of testing in the of line system is the ability to use open tests when developing test tasks, which is not always possible when testing through a computer program. Wherein, computer technologies are used only to form a test base (a pool of questions) and form tests from it at a client request.

Testing in *online format* requires the development of a testing program. It is possible to develop such a program based on platforms: Drupal (Author, 2014), Moodle (Medvedeva, 2002), Sakai (Author, 2015), Blackboard, and etc. However, they all have limited application, especially for mathematical tests associated with a large number of formulas integrated into the program. It is much more efficient to develop your own shell designed for testing control.

The original shell will take into account all the requirements that correspond to the set goal, include all the necessary options. If at the same time the test base is well structured and based on modern data storage technologies, then it is easy to automate the formation of test tasks and announcement of test results. The widespread use of the testing program in the educational process requires a convenient, accessible to any user, method of replenishing and updating the database of test questions – “a database adds what we call delivery time flexibility” (Brusilovsky, 1999). Only its own original shell will make it possible to develop new tests based on it and/or update and replenish the test base

2.3.5 Online Testing

At SPbGMTU, for the current computer control of the level of knowledge of the academic group, the original testing program, made by the authors, is used. When using this program, the teacher sets the rating and grade in accordance with the number of correctly solved problems in the corresponding options of the program.

All results of the testing session are displayed to the user on the screen. The testing program provides for free navigation through the test items, i.e. the user can answer test questions in a convenient order.

The tests contain tasks with closed answers. Some of the tasks are of a theoretical nature, while the other part of the test tasks requires the ability to apply the knowledge gained to solve practical problems. When an attempt is made to end a testing session, the user is presented with a warning that prevents accidental termination of the session.

After passing the test, its results are announced in the window that opens (Fig. 2). The test results include:

- the number of correctly solved problems;
- the number of correctly solved problems as a percentage of the total number;
- numbers of incorrectly solved problems.

Testing with this program is intended for use in a computer room. Since at this each entry into the program, both the order of the test tasks and the numbers of the answer options are mixed, then "cheating from a neighbor" is excluded.

The program can also be used in the remote access system, since for the teacher the results are saved in

the "User Diary", which can be viewed by him/her at any convenient time.

Updating tests when using this program is carried out directly through its open source, both by adding new questions and by forming a new test from existing test items. More details about the program's capabilities are described in (Author 2016, 2017).

2.3.6 off Line Testing

The SPbGMTU developed a computer program "Formation of Tests" (Author 2008), on the basis of which test options are formed from the existing database on the given topics, which, together with the matrix of answers, are issued in printed form for testing. This program is successfully used in the educational process of SPbGMTU.

The test base is developed using ACCESS technologies, and formation is based on client requests and is carried out using SQL – Script operators. The program is very easy to use, because test problems are added to the database as they are developed. In this case, it is possible to use the table mode and the form mode (Fig. 3). The text of the problems is written in the Microsoft Word editor with the ability to use the Mat Type formula editor.

Formation of the test is carried out through the start form at the client's request, which includes (Fig. 4):

- - the number of tasks in the test;
- - number of options;
- - names of testing topics;
- - the level of difficulty of the test items.

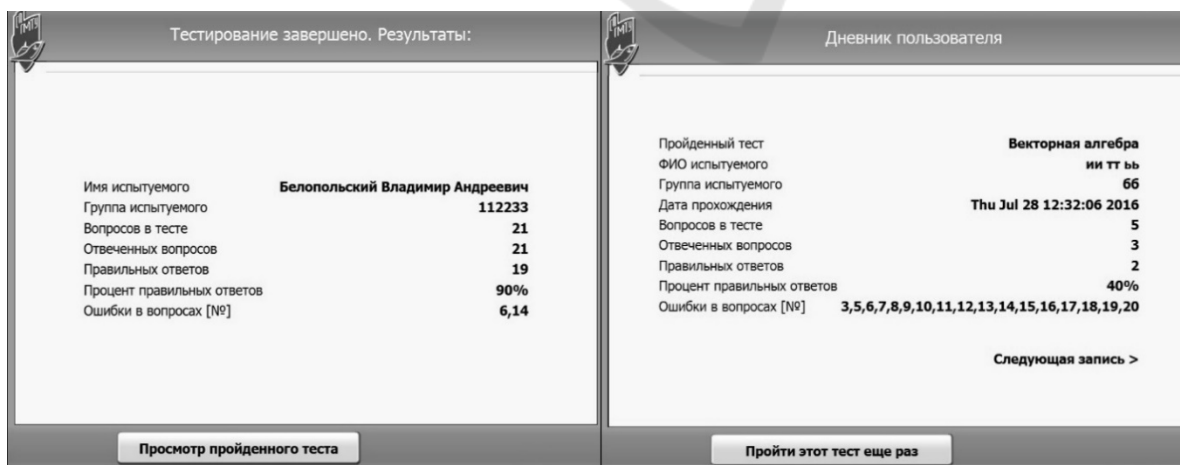


Figure 2: Visualization of test results.

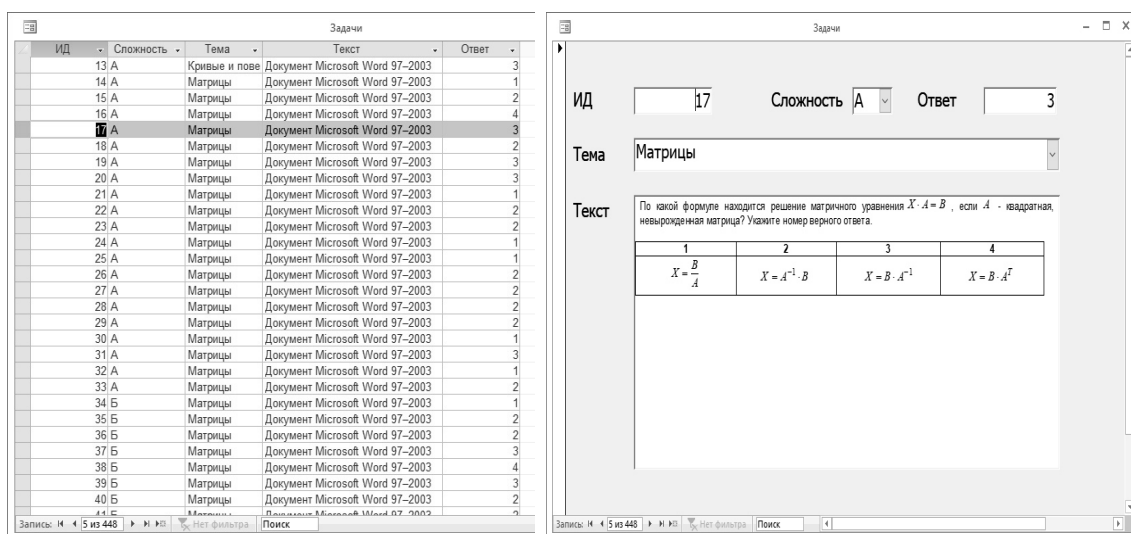


Figure 3: Database in Table Mode and Form Mode.

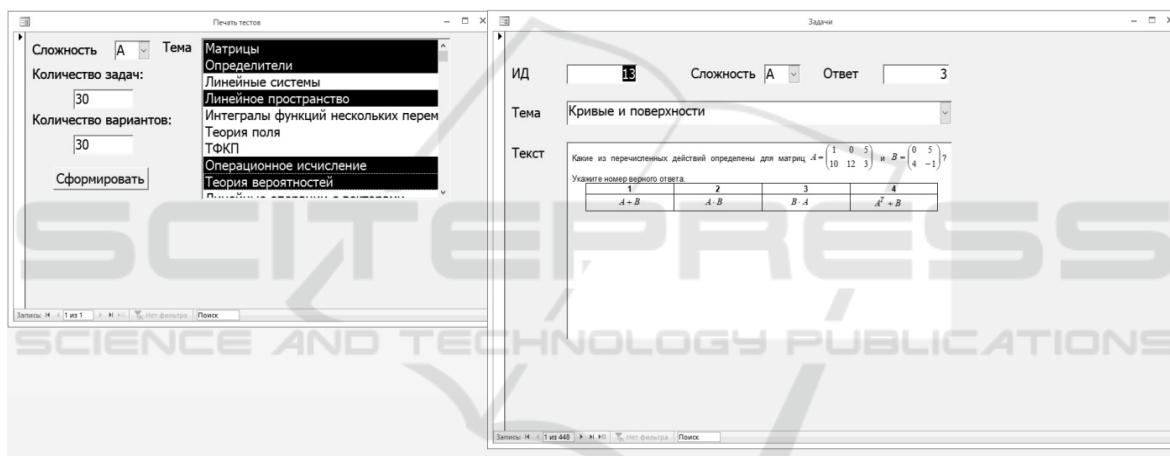


Figure 4: Forming a test and viewing it on the screen.

The generated tests can be viewed on the screen, they can be edited, they can be saved using the provided "Menu of ready tests", they can be printed by accessing the "Print test" tab. The user is given two reports: the ordered number of test options and a matrix of answers to them (Fig. 5).

Use of the program allows for a testing session in any classroom. Tests in printed form are offered to the test subjects. At the end of the session, they present a ticket with the numbers of the correct (according to their solution) answers, and also present solutions to some problems indicated by the teacher. This format of testing sessions is very similar to the form of the USE and, therefore, is well known to students.

3 DISTANCE LEARNING EXPERIENCE

The experience of two years of distance learning shows that there has been no decline in the quality of education. The teaching load of teachers and the volume of independent work of students have increased. The form of personal contact between teacher and student has changed, but modern communication means make it possible to successfully implement this contact in the remote access system.



Figure 5: Test format and response matrix.

Moreover, academic performance not only did not decrease, but even increased, especially in the first year, which from the first days of training was involved in the educational process in a distance format. The number of unsatisfactory ratings has not decreased in comparison with the previous streams, but the number of "good" ratings has increased significantly. This rating is becoming the most popular.

Despite the fact that online testing can be carried out in a remote access system, it turned out that repeated testing outside the computer room is not convenient, since the generated user diaries that save the results for the teacher need to be deleted regularly, which takes a lot of time. However, it is convenient to use the testing program posted on the site for personal monitoring of the level of knowledge. The student enters the program through authorization (Fig. 6) and selects a test from the list (Fig. 7).

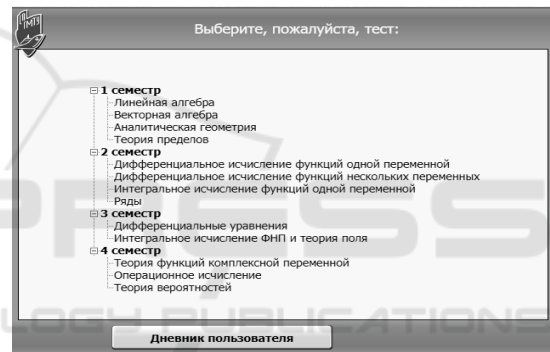


Figure 7: Test selection.

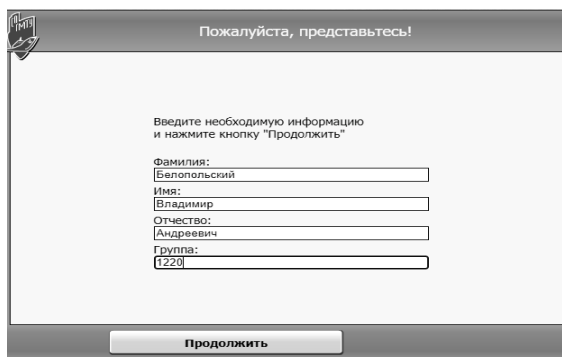


Figure 6: Authorization of the test subject.

Since he/she is given a message about the numbers of incorrectly solved problems, he/she can view the test, understand his/her mistakes and pass it again. In difficult cases, the student can contact the teacher.

During the period of distance learning, the program for generating tests from a database turned out to be very useful and in demand (Fig. 4, 5). It turned out that it can also be used when conducting a lesson in the form of an online conference: the formation of a test takes several minutes, the teacher sends a set of formed test options to students via e-mail. After completing all the assignments, students fill out a ticket with answers. Since the teacher has a matrix of answers, he/she can conduct a preliminary check right in the classroom, asking to show the completed ticket with answers to the camera and read out the numbers of incorrectly solved tasks, and as homework ask to complete their detailed solution.

4 CONCLUSIONS

The pandemic has come, the pandemic will go away, and the use of powerful information resources during the period of the distance educational process will form a different quality of competencies for both teachers and students. The widespread use of elements of distance learning and computer technologies in the subsequent full-time form of the educational process will inevitably increase its quality.

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