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ASSESSMENT OF SCHOOLCHILDREN'S KNOWLEDGE IN THE FORM OF ADAPTIVE TESTING

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Abstract

The article discusses one of the ways to assess students' knowledge, namely adaptive testing. Currently, one of the problems of education is the decline in the quality of mastering the content of education. This circumstance leads to the loss of students' motivation to master the educational material and the need for further training in the subject. The educational process in its structure involves the mandatory conduct of attestation activities. In this study, an example of an adaptive test is proposed based on mathematical material. The article compares adaptive tests in mathematics with other forms of knowledge control. A method for creating adaptive tests in mathematics is demonstrated. Methods for conducting adaptive tests and mechanisms for evaluating passed tests are proposed. The main idea of adaptive testing is that test tasks must be structured and adapted according to difficulty, depending on the level of preparedness of the test subjects in the test group. At the same time, the researchers proceed from the consideration that it is useless for students with poor preparation to give difficult tasks since with a high degree of probability they will not be able to complete them correctly. Equally useless are easy items when testing well-prepared test subjects because most students will get comparable high scores and therefore no objective measurement will take place. Adaptive testing is considered a new, more objective way of assessing knowledge, considering the level of knowledge of the student, including in the digital educational environment.

Keywords: Adaptive testing, digitalization, knowledge assessment methods

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1. Introduction

The article is based on the belief that mathematical knowledge, skills, and abilities can be strictly differentiated from simple to complex. Such a division of mathematics into separate, smaller subtopics would make it possible for the teacher to form the space of an educational “road map” with the possibility of building detailed routes for teaching students. Educational "road maps" make it possible to consider the individualization of educational trajectories.

At present, the decline in the quality of mastering the content of education is one of the problems of education. Many students hardly get a three in a year, they have not mastered the most important mathematical knowledge and skills. However, such students move to the next class and begin to fall further behind. This process leads to the loss of students' motivation to master the educational material and the need for further training in the subject. Moreover, underestimation of the importance of mastering key topics or sections of mathematics makes it impossible for a student to form a coherent and logically built subject-mathematical picture. There are frequent examples of changes in the educational dominance of the student in favor of other areas of training and areas of scientific knowledge. This approach is determined and strengthened, among other things, by profiling the areas of study for high school students.

2. Problem Statement

The specificity of the current stage in the development of scientific knowledge lies in the fact that the solution to research problems from the position of integrating knowledge obtained within and from the point of view of different sciences is becoming the norm (Zubikova, 2016). Such integration of scientific knowledge leads to the enrichment of private scientific methodologies with the methods of related sciences, to the active borrowing of scientific methods, their adaptation to the specifics of a particular science ( ). The possibility of implementing the educational process within the framework of integrative interaction positively changes the methodology of the educational process, the nature of subject-subject relations, professional and personal qualities of a specialist (Larionov, 2011). In this regard, the synergistic effect of building educational technology in mathematical disciplines based on system-activity and axiological approaches in the methodology of pedagogy acquires a tangible sign of achieving the planned educational result. So, Kraevsky, considering the problem of the connection between science and practice, which is “the main, and in a certain sense the only problem of the methodology of pedagogy, since it expresses the essence of its subject.” At the same time, he clarifies that “it would be more accurate to single out a system-activity approach that integrates the representations of the system and activity methods of considering the phenomena of pedagogical science and practice” (Kraevsky & Polonsky, 2001, p. 66).

3. Research Questions

The educational process in its structure involves the mandatory conduct of attestation events (Klochkova & Sadovnikova, 2019). The choice of their form by the teacher directly affects the stimulation of the student to cognitive activity and an objective assessment of the level of formation of the

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cognitive and activity spheres of the personality. Thus, propaedeutics and the organization of educational activities directly depend on the qualitative assessment of knowledge (Kudinova et al., 2018; Kudinov & Kudinova, 2020). At the same time, the mathematical and natural science fields of knowledge have specifics in the context of the unambiguous interpretation of axioms, lemmas, and theorems as the foundation of the content of education. Let's follow methodically what forms of assessment of knowledge in mathematics are used most often:

- Oral questioning.
- Written test papers.
- Tests.
- Short answer test papers.
- A combination of the above methods.

All these forms are undoubtedly historically determined and demonstrate positive didactic results. An oral survey allows a professionally competent teacher determining the strengths and old sides of students accurately and quickly. Various test papers also allow making a general cut of students' knowledge.

However, all these methods have their drawbacks. In an oral survey, the teacher's subjective assessment can significantly distort the perception of the student's real knowledge. Here there is a frequent conflict between the representation of the content of education by the teacher and the degree of creativity of its transformation when the student answers. Testing papers are limited in assessing knowledge since the number of tasks is limited and strictly standardized in advance.

As a null hypothesis, suppose that the student was unable to solve any of the tasks when passing the test. Of course, such an event is possible and certainly indicates that the student is unacceptably far behind in mastering the educational material. In this case, a natural question arises: “How much?”.

Based on an integrated scientific and pedagogical theory, we believe that the system of adaptive testing allows correcting the above problems in mathematics education to a greater extent.

4. Purpose of the Study

The purpose of this work was to study adaptive testing as a new, more objective way of assessing knowledge, considering the level of knowledge of the student, including in the digital educational environment.

5. Research Methods

The work uses general scientific methods: synthesis, analysis, comparison of empirical material; a descriptive method that includes observation, generalization, and classification techniques. The study of the material using proper mathematical methods made it possible to obtain objective results.

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6. Findings

The main idea that drives researchers in the field of adaptive testing is that test tasks must be structured and adapted in terms of difficulty to the level of preparedness of the test subjects in the test group (Minko, 2007). At the same time, the researchers proceed from the consideration that it is useless for weak subjects to give difficult tasks since with a high degree of probability they will not be able to complete them correctly. Equally useless are easy tasks when testing strong subjects. The use of tasks that are too easy can lead to the fact that most students will receive comparable high scores and, therefore, the measurement will not take place due to a discrepancy between the level of difficulty of the tasks and the level of preparation of the tested students.

The development of questions for adaptive testing based on the “Number of developers” can be divided into individual (developed by one teacher) and collective (developed by two or more teachers).

Consider an individual way of creating adaptive testing.

This methodological technique involves the creation of many questions with a choice of answers and a strict sorting of these questions according to the level of complexity (Golanova & Golikova, 2010). Creating an adaptive test involves several steps that the teacher must take:

1. Definition of all topics studied in the school curriculum;

2. Sort these topics from easy to hard. Moreover, each topic should not be based on the theory that will be later;

3. Develop several questions on each topic and assign these questions a level of difficulty on a hundred-point scale (the scale can be divided into tenths, hundredths, etc.). The questions of each specific topic may cover the theoretical material that was in the previous topics;

4. Create questions that combine several topics at once and assign a certain level of difficulty to these questions.

As a result of the implementation of all stages, the teacher forms a list of questions sorted by difficulty level. This base is the main material of the adaptive test.

The collective creation of tests involves the cooperation of two or more mathematics teachers. The role of the regulator of this cooperation is a certain online platform.

As a result of the collective way of creating questions for online testing, a more objective list of questions should be formed.

With the collective method, each teacher:

- creates questions and sets the level of difficulty on a 100-point scale;
- Views questions created by other teachers and votes to lower or increase the level of difficulty of other people's questions;
- evaluates the quality of other people's questions.

Thus, the collective method forms an objective list of quality questions for online testing.

Passing the adaptive test.

The adaptive test is divided into several blocks. In the first block, the student is offered 7 questions of medium difficulty (complexity level 50). If students answer more than 3 questions correctly, they move to the block with more difficult questions (difficulty level 75). If students answer 3 or fewer questions,

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they move to the block with easier questions (level of difficulty 25). Based on the results of passing the second block of questions, the next block is selected according to the same logic (Figure 01).

The diagram of the transition between blocks is shown in the figure below.

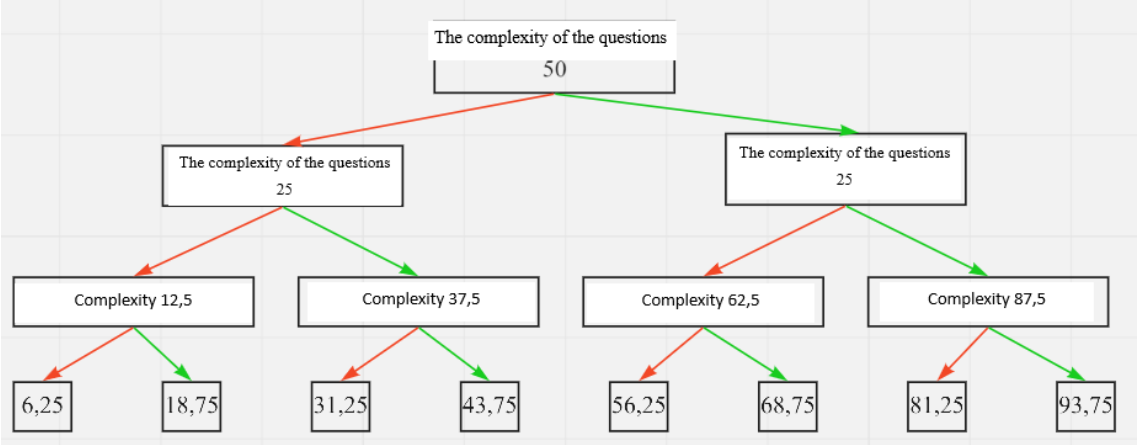

Figure 1. Adaptive Test Blocks

The number of questions in blocks can be regulated. Also, the need for a more accurate assessment of knowledge causes changes in the number of blocks.

7. Conclusion

The proposed mechanism of adaptive testing selects for students exactly those tasks that will be within their power. The obvious conclusion is that the more questions there are in the database, the better. Adaptive testing allows the teacher to be more objective and the students to be more productive. The results of adaptive testing give an understanding of what level each student is at and increase the individual approach to students with different levels of preparation. This approach is well implemented with the help of automated platforms when organizing certification events in distance learning. With an increase in the sample base of the number of questions, the validity of an objective assessment of the quality of knowledge of students in a digital educational environment increases.

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