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Issue Article

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THEORETICAL ASPECTS OF ASSESSING STUDENTS' LOGICAL THINKING BASED ON INTERNATIONAL TIMSS PROGRAMS

Abstract: *TIMSS (The Trends in International Mathematics and Science Study)— this is an international study of the quality of mathematical and natural science education. The article examines the theoretical aspects of assessing logical thinking, which allows comparing the level and quality of mathematical and natural science training of secondary school students in different countries of the world, as well as identifying and comparing changes taking place in national education systems.*

Key words: *TIMSS, science, integration, logical thinking, creativity, technology, non-standard tasks.*
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Introduction

Today, the change of the educational paradigm has made assessment not just a statement and a test, but also a formative of logical thinking, defining and predicting, stimulating, motivational, school and professional orientation. Assessment ceases to be an application to the educational process, it is constantly progressing, becoming one of the most important factors of learning, capable of influencing the areas and conditions of learning and upbringing.

In order to meet the requirements of the new information society, assessment functions acquire a new meaning, change the goals of education and assessment. It should be aimed not just at identifying shortcomings, it should be a mechanism that ensures the continuity of the process of improving the quality of education, should provide a constructive connection for all subjects of the educational process. It should not just sum up what has been achieved, but become a starting point, followed by a new round of development, reaching a new level of education. Awareness of the importance and attention to the modernization of the system for assessing the logical thinking of students gives hope for the creation of its new model and not repeating the mistakes of history.

It is advisable to preserve and disseminate all the positive that has been accumulated and change what hinders the development of the education system (subjectivism, focus on checking factual material, insufficient use of control tools that form the interest of each student in the results of their cognitive activity, the incompatibility of control results across schools, etc. .e).

The freedom of choice provided in this matter has led to a variety and diversity of forms, types, methods, models, which is a certain obstacle to choosing the optimal and acceptable option for all participants. At the same time, this also reflects the objective need to use this multidimensionality in full volume. Analyzing the work done in this direction, we can divide all options into 2 groups: Quantification (options with a point system):

- no marks assessment;
- extended evaluation;
- rating assessment;
- criteria-logical;
- multi-point system (from 10 to 100).

Much has already been said about the inconsistency of the existing 5-point system, but it is obvious that it has advantages without which it would

not have existed for so long (simplicity, clarity for the subjects of the process, tradition, rootedness, universality, strength, modernization potential) and which we would like to see in a future model.

Authentic assessment options:

- portfolio;
- a chest of regalia (a collection of works made by the students themselves);
- Scottish certificate (entries in the certificate are the result of a discussion of progress with the tutor);
- creative book (all independent work done in excess of the curriculum);
- notebook-passport (answers questions want, can, eat, should be);
- profile of skills, development of logical thinking.

The teacher should not forget that cognition is a process, it is extended in time, with stages. It is psychologically unjustified to give marks to something that is still in its infancy, that will change, be refined in the future when assimilating new knowledge.

The new goal of education was proclaimed the upbringing of a self-developing personality, that is, "the goal of teaching a child is to make him able to develop without the help of a teacher" (E. Hubbard). This model, no doubt, includes basic knowledge and skills, but the most important component is the student's ability to organize independent activities and implement reflexive actions in case of difficulties encountered, master the system of orientation in the sea of information, as well as the formation of skills to constantly replenish and complete their personal knowledge system. Alvin Toffler wrote about this 40 years ago: "The new education must teach the individual how to classify and reclassify information, how to assess its validity, how to change categories if necessary, how to move from the concrete to the abstract, how to look at problems from a new angle, how to educate oneself ... The illiterate in the future will be the wrong a person who cannot read, and one who has not learned to learn. Naturally, in this case, the degree of individual advancement in the mode of self-development should be assessed. Based on this, the assessment of achievements should be carried out on 2 grounds: on the conformity of the results of educational activities to a certain educational standard.

On the personal advancement of students on the ladder of achievements in the process of mastering knowledge, skills, development of mental processes, formation of value orientations, personal qualities.

When considering evaluation, another difficult question arises: what is to be evaluated. The abundance of planned educational outcomes are formulated in such a way that they turn out to be unverifiable within the framework of the educational process by means of pedagogical diagnostics (for example, "to form knowledge about ...", "broaden one's horizons ..."). The number of objects of assessment is large. For example, what types of work to evaluate, what level of complexity. Consideration of the system for evaluating the dynamics involves diagnosing a personality on a regular basis according to a fairly large number of criteria, which is certainly a difficult, but solvable task. Each task can be evaluated in terms of deadlines, compliance with the form, goal compliance, resource compliance, and stability of competencies. Within the framework of the modern structure of the content of education, an objective assessment system cannot exist. It is necessary either to highlight the so-called key elements of the content, the measurement of which is sufficient to obtain the desired result, or to change the structure of the content of the education system.

The finalization of the calculation algorithm for all subjects, for different ages and, possibly, for different learning systems, remains relevant. It is impossible to equate the activities of a second-grader and a fifth-grader, even, it would seem, of the same objectivity. Therefore, the assessment system should have a bank of assessment materials for at least 5 levels of intra-school control: at the entrance to the elementary school, at the entrance to the main school, at the turn of 11-12 years (middle of the main school), at the end of the main school, at the end of the senior schools. For each, materials are developed that allow assessing the level of formation of key competencies characteristic of a given age interval.

The new school should have an approach to evaluating the results of schoolchildren's performance that is adequate to the ideas of developmental education, and the implementation of the ideas of a competency-based approach, the development of new criteria for evaluating the results of schoolchildren's performance should have a pronounced focus on the development of relevant competencies and self-assessment skills.

The volume of problems in solving this issue is astonishing. Many are under development, many are under development. But the goal of all transformations is the same - assessment from a means of compulsory education that was unloved for a student in the past should turn into a way to rationally determine a personal rating - an indicator of a person's significance in a civilized society.

The Trends in International Mathematics and Science Study (TIMSS) is a periodic monitoring study of the quality and trends in the development of mathematics and science in national education systems. Allows you to compare the level and quality of mathematical and natural science training of secondary school students in different countries of the world, as well as identify and compare changes taking place in national education systems. It is carried out by the International Association for the Evaluation of Educational Achievements (IEA) in consortium with

leading international scientific organizations, with the participation of national centers. The international focal point for the study is Boston College (International Study Center, Boston College), USA.

The purpose of the study is a comparative assessment of the general educational preparation of secondary school students in mathematics and natural science in countries with different education systems, and the identification of factors affecting the level of this preparation. The study is conducted in such a way that its results make it possible to track trends in mathematics and science education every four years, when students in grades 4 become students in grades 8. Additionally, the features of the content of mathematical and natural science education in the countries participating in the study, the features of the educational process, as well as factors related to the characteristics of educational institutions, teachers, students and their families are studied.

The methodological basis of the study is a conceptual model for assessing the educational achievements of students, which allows analyzing the relationship between the planned and implemented levels of education, on the one hand, and the achieved level of education (learning outcomes), on the other hand.

Within the framework of this model, education is considered from the position of three levels:

• The planned level is a social order for an educational institution. At the planned level, the official goals of education and the totality of pedagogical and methodological ideas accumulated in society are formed, which is reflected in curricula and teaching aids.

• Realized level — the real educational process of an educational institution. At the implemented level, the teacher of the educational institution forms the planned content of education in the real educational process.

• Achieved level - the results of training in an educational institution.

This is done so that countries can identify the strengths and weaknesses of math and science education in their countries based on international comparisons.Research tools include:

- tests of students' achievements;
- Questionnaires of respondents (students and teachers, administration of the educational institution, national coordinator and international observer for the quality of the research);
- methodological complex (guidelines for national and school coordinators on the organization and conduct of research, sampling, testing, checking tasks with free answers, data entry);

software package (international and national databases of schools, classes and students, research results).

The main component of the study are blocks of tests, which are developed on the basis of the following principles:

- adequate coverage of the checked content and types of educational and cognitive activities;
- maximum correspondence of their content to the studied materials of the participating countries;
- the significance of the educational material being tested in terms of the development of mathematical and natural science education;
- compliance of tasks with the age characteristics of students.

The IEA management gladly accepted the offer of Uzbekistan to participate in this study and made recommendations on what educational conditions in Uzbekistan correspond to the TIMSS educational system. In addition, the IEA invited our country to the first meeting of national research coordinators, scheduled to be held in Hamburg, Germany in February 2021, and announced that it will provide an opportunity to discuss with Boston College specialists various evaluation models, discuss the benefits and shortcomings of research directions. TIMSS (Trends in International mathematics and science study) is a program for assessing the level of proficiency of 4th and 8th grade students in mathematics and science subjects, and this study is carried out every four years.

In addition to comparing the level and quality of knowledge acquired by 4th and 8th grade students in mathematics and science, as well as identifying differences in the national education system, TIMSS also examines the content of education received in mathematics and science in schools, the educational process, opportunities of an educational institution, the potential for its development.

Pedagogical tasks can be presented both in the traditional form in the form of questions, tasks, term papers, practical tasks, and in test form, which are more technologically advanced and can be used in various teaching technologies.

Task systems in the test form form such tasks that have all the features inherent in tasks in the test form, but do not have the properties of test tasks. Task systems in test form are developed and used for pedagogical assessment, which does not claim to meet the strict requirements of the scientific and pedagogical measurement.

Principles for selecting test content

Significance - this principle indicates the need to include in only those elements of knowledge that can be attributed to the most important, key, without which knowledge becomes incomplete, with numerous gaps. Therefore, only those materials that play the role of learning elements in individual knowledge should be included in tests.

Scientific reliability: the test includes only that content of the academic discipline that is objectively true and lends itself to some rational argumentation. Accordingly, all controversial points of view; it is

recommended to include in test tasks, you conclude the essence of test tasks; since they require a clear, pre-known answer, it is recognized by the process of developing tasks as objectively true.

Correspondence of the content of the test to the level of modern consciousness - this principle follows from the natural need to train specialists, test their knowledge and skills on modern material, an adequate level of development of science and the content of the academic discipline.

Representativeness: the test not only includes significant elements of the content, but also pays attention to the completeness and sufficiency of control. Representativeness does not mean that all significant elements of the content must be included in the test. After all, many of them are clearly interconnected in the general structure of knowledge, included in one another in whole or in part.

Content variability: the content depends on the development of science, scientific and technological progress, the new content of the academic discipline, and new textbooks. As the content of the academic discipline changes, the content of the test should also vary. At the same time, it is necessary to take into account the contingent of students, their level of preparedness, training.

Consistency of content - this means the selection of the content of test items that would meet the requirements of systematic knowledge, that is, in addition to the selection of items with systemic content, it is important to have tasks that are interconnected by a common knowledge structure. The complexity and balance of the test content: a test designed for the final control of knowledge and skills cannot consist of the material of only one topic, even if this topic is the most key in the academic discipline. It is necessary to look for assignments that comprehensively reflect the main, if not all, topics of the training course.

Requirements for tasks in the test

V.S. Avanesov emphasizes that tests are used to objectify the control of learning outcomes. To activate the current educational activity, not tests are used, but sets of tasks in a test form, which, unlike test tasks, do not form a test.

The tasks in the test form are subject to the following set of requirements:

- brevity,
- manufacturability,
- the correctness of the form,
- content correctness,
- the logical form of the statement,
- the same rules for evaluating answers,
- the presence of a certain place for answers,
- correct arrangement of task elements,
- the same instructions for all subjects,
- Adequacy of instructions to the form and content of the task.

The brevity of tasks in the test form follows from the advantages of the logical form of the statement, so tasks are always shorter than tasks and questions. Brevity is ensured by a careful selection of words, symbols, graphics, allowing a minimum of means to achieve clarity of the meaning of the content of the task. Repetitions, obscure, rarely used, as well as symbols not known to students, foreign words that make it difficult to perceive the meaning are excluded.

The correct location of the task elements is a requirement that helps students not to waste time determining the place for answers and quickly fix their solution.

The similarity of the rules for evaluating answers within the accepted form is an objectified means of organizing testing. No student is given an advantage over another: everyone answers the same tasks, everyone is given the same time. Evaluation rules are predetermined and apply exactly the same to everyone.

The answer to the task is a brief judgment related to the content. The criterion for the correctness of answers is determined in advance by the author of the task. The adequacy of the instruction to the form and content of the task means the mutual correspondence of the listed components, which is necessary for the task to perform its function. The condition of adequacy allows you to bring to the consciousness of students the requirements inherent in the content of the task. The discrepancy causes errors in understanding the meaning of the task, and, accordingly, leads to erroneous answers.

In addition, when compiling test tasks, the following basic rules must be observed:

• it is impossible to include in the totality of answers those, the incorrectness of which at the moment cannot be recognized by the students;

• wrong answers should be formulated on the basis of typical mistakes and should seem plausible;

• correct answers among all answers must be placed in a random order;

• questions should not repeat the wording of the textbook;

• answers to some questions should not be "hints" for answers to others;

"Non-standard tasks are those for which there are no general rules and regulations in the course of mathematics that determine the exact program for their solution.

"Non-standard tasks must be selected in accordance with the age characteristics of schoolchildren and the requirements of the program of the state standard of general education. The effectiveness of teaching schoolchildren to solve non-standard problems depends on several conditions.

First, tasks should be introduced into the learning process in a certain system with a gradual increase in complexity, since an overwhelming task will have little effect on the development of students.

Secondly, it is necessary to provide students with maximum independence in finding solutions to problems, to give them the opportunity to go to the end along the wrong path, to be convinced of the error and return to the beginning and look for another, right way of solving.

Thirdly, students need to be helped to understand some ways, techniques, general approaches к solving non-standard problems in physics.

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