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RESEARCH NOTES

Testing: Methodology and Quality Indicators

Pruebas: metodología e indicadores de calidad

Zubanova Svetlana*
Moscow Aviation Intitute (National Research University), Moscow, Russia
ORCID: https://orcid.org/0000-0003-4904-9342

Bodrova Tatyana
Peoples' Friendship University of Russia (RUDN University), Moscow, Russia
ORCID: https://orcid.org/0000-0003-0314-2410

Kruchkovich Sofia
Financial University under the Government of the Russian Federation, Moscow, Russia
ORCID: https://orcid.org/0000-0002-8789-0135

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***Correspondence**

Email: ZubanovaSG@mail.ru

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Summary

Testing is a modern high-quality method of knowledge check. Informatization which began in the late XX – early XXI century contributed to the growth of various tests. However, the inclusion of tests in the educational process is at a slower pace. This is largely due to the lack of a methodological basis for test development. It is proved that the test control methodology is an interdisciplinary theory that combines the achievements of pedagogy, psychology, measurement theory, quality theory, statistics, mathematics, organization and management theory. The article describes the principle of the testing methodology; the type and kinds of tests are determined, as well as the methodological principles for high-quality text creation. The criteria are described that must be met by tests: relations with education and training, objectivity, systematicity and comprehensive nature, relevance, the relationship of increasing difficulty content and form, and test optimality.

Keywords: Testing; Methodology; Test Quality Indicators; Control; Education System; Russian Federation.

Resumen

La prueba es un método moderno de verificación de conocimiento de alta calidad. La información que comenzó a fines del siglo XX y principios del siglo XXI contribuyó al crecimiento de varias pruebas. Sin embargo, la inclusión de pruebas en el proceso educativo es más lenta. Esto se debe en gran medida a la falta de una base metodológica para el desarrollo de pruebas. Está comprobado que la metodología de control de prueba es una teoría interdisciplinaria que combina los logros de la pedagogía, la psicología, la teoría de la medición, la teoría de la calidad, la estadística, las matemáticas, la teoría de la organización y la gestión. El artículo describe el principio de la metodología de prueba; se determinan el tipo y los tipos de pruebas, así como los principios metodológicos para la creación de textos de alta calidad. Se describen los criterios que deben cumplirse mediante las pruebas: relaciones con la educación y la formación, objetividad, sistemática y naturaleza integral, relevancia, la relación entre el contenido y la forma de dificultad creciente y la optimización de la prueba.

Palabras clave: Pruebas; Metodología; Indicadores de calidad de las pruebas; Control; Sistema educativo, Federación de Rusia.

Introduction

Testing is one of the important tools for obtaining pedagogical information in the learning process, the most objective and high-quality way to control knowledge, and skills. Such characteristics of this type of control as the possibility of equal condition creation for all students, common criteria for achieved result evaluation and interpretation, contributed to its widespread penetration into the practice of teaching in general and higher education.

Consideration of testing in the context of the interconnected problems of education quality improvement and its informatization relevant to the modern Russian school allows us to talk about shifting the emphasis from the purely controlling function of a single test control "for all" to its hidden varied diagnostic and training opportunities.

Problem Statement

In the 2000-ies, active informatization took place as the part of various programs aimed at all levels of Russian education development: an array of innovative, electronic, developments supporting the Russian State educational standards of basic and secondary (complete) general education was replenished annually. An important place in this array is occupied by computer

training and control systems, including diagnostic tests (Adonina, Bondareva, Fisenko, & Ismailova, 2018; Bayramova, 1999; Fisenko, Nikitina,& Sokolova, 2019; Kornilova, Matveenko, Fisenko, & Chernova, 2015; Rumyantseva, Fisenko, & Suvorova, 2018; Fisenko, , Tazheva,& Masyuk, 2018).

At the same time, despite the presence of practical developments in the field of computer testing and training that implement the specific capabilities of the computer as a flexible, adaptive learning tool, they are not widely applied in the practice of teaching at school and university (Polyanskaya, Fisenko, & Kulakova, 2018). The reason lies not only in the well-known tradition of the pedagogical environment, which tends to rely on already known and tested means, but also in the absence of mass experience of innovative electronic pedagogical tool introduction into teaching practice (which are essentially complex and multifunctional information and educational systems), as well as in the absence of technological and methodological descriptions, offering the ways and methods of their integration into the current educational process and effective use algorithms.

Problem Discussion

Testing methodology basics

The methodology of pedagogical testing can be defined as the doctrine of the main provisions, forms, methods, principles of scientific research and the effective organization of practice in the field of pedagogical control and student training level assessment. The principles of test control scientific organization are formulated in the form of basic rules that contribute to testing effectiveness increase.

Some of the most general rules, mostly recommended by V.S. Avanesov, are given in the form of a number of principles:

- the connection of test control with education and training, which emphasizes that training without further testing is inefficient, since only objective control shows in which direction further training should be adjusted;
- objectivity, aimed at the need to eliminate subjectivity and bias;
- fairness and publicity, meaning equally benevolent attitude to all subjects, openness of all stages of testing, timeliness of familiarization with the test results;
- scientificity and effectiveness, prescribing the need to verify the results for reliability and validity;
- systematicity and comprehensiveness, emphasizing the need to coordinate the goals and results of the current, milestone, thematic and final control, and their scientifically based frequency;
- scientific credibility, requiring only true knowledge to be included in the content of tasks and the elimination of controversial ones;
- systematic content, meaning the need to include in the test knowledge related to each other by a common structure;
- the compliance with development, requiring the comparison of a discipline content with the current state of science;
- significance, involving the selection of the most important, key knowledge;
- representativeness, requiring the inclusion in the test content not only significant and scientifically reliable information, but also taking into account the completeness and sufficiency of controlled material volume;
- the content variability, suggesting a constant change, redesign and improvement of the test content in accordance with the development of science and educational standard changes;

- the complexity and balance of the test content, paying attention to the need to display the main topics of the training course, the combination of theoretical, historical, factual and practical knowledge;
- the relationship of content and form as the way of the discipline content reflection in a test content most fully; one of the important conditions during a quality test creation is the requirement to combine organically the contents of the tasks with the form of their presentation, since outside the test forms, neither the test nor its contents make it possible to talk about the test at all;
- the increasing difficulty of controlled knowledge (for a homogeneous test or within the thematic completeness of individual parts of the test, subtest);
- the test optimality, dictating the need for strict selection of the test content. It should be borne in mind that it is impossible to fully invest the content of the discipline in one test, and therefore, only that basic thing is selected for the tests (especially the final control) that pupils or students should learn after the discipline study.

In the works by S.I. Arkhangelsky attention is drawn to two principles in the test content: scientific and educational. Scientific reflects the process of science development and its applicability, and educational reflects the principles of knowledge system development (Arkhangelsky, 1974).

The content of a test depends on the purpose of the test and the amount of controlled training material. Accordingly, the type of test is selected (homogeneous, heterogeneous, integrative, adaptive, etc.). Since the test is created to solve certain problems, it is suitable only for those tasks and goals for which it was created.

In accordance with the testing methodology and the basic principles of its organization after structuring, a test is carried out to check the test for compliance with the planned characteristics. At that, the process of test application provides for the fulfillment of a number of requirements:

- organization of control in accordance with the developed instructions;
- test subject preliminary training conduct;
- mandatory creation of appropriate conditions for testing: places, equipment, devices, software and methodological materials;
- creation of favorable psychological conditions;
- presentation of a test in an effective form;
- optimization of the scoring system, the methods for their presentation and result interpretation.

It should be noted that during testing both the knowledge of the educational material and its ignorance are revealed, and this makes it possible to widely use testing for diagnostic purposes, to prepare diagnostic tests with a special selection of content that allows to assess the strength of knowledge, completeness, depth, flexibility, specificity and generalization, systematicity and, effectiveness. It is the task that determines and points to the means of pedagogical influence, reveals the content, the inner side of the pedagogical process and the pedagogical concept under knowledge control.

Test Quality Indicators

For the pedagogical measurement, the selection of the academic discipline content and the formation of the optimal number of units of knowledge, one can use the classifications of controlled knowledge and abilities developed by B. Bloom and R. Gange. In Russian literature, the most detailed various types of knowledge are presented by V.S. Avanesov, namely:

1) names; 2) the meanings of names; 3) factual knowledge; 4) knowledge of definitions; 5) comparative knowledge; 6) classification knowledge; 7) knowledge of opposites, contradictions, synonymous and antonymic objects; 8) associative knowledge; 9) causal knowledge and the knowledge of causal relationships, classification grounds and principles; 10) procedural and algorithmic knowledge; 11) technological knowledge; 12) generalized, systemic knowledge; 13) evaluative knowledge; 14) probabilistic knowledge; 15) abstract knowledge; 16) structural knowledge; 17) methodological knowledge.

The list of types of knowledge used to prepare test tasks can be expanded or, summarized, reduced depending on the objectives of control.

According to J.A. Bayramova, the methodology of pedagogical testing can be defined as "the doctrine of the main provisions, forms, methods, the principles of scientific research of the effective organization of practice in the field of pedagogical control and the assessment of the student preparedness level" (Bayramova, 1999).

In this regard, the main principles are distinguished:

- The relationship of test control with education and training, which emphasizes that training without further testing needs to be adjusted for further training.
- Objectivity, which is aimed at elimination of subjectivity and bias.
- Scientificity and effectiveness, requiring the verification of results for reliability.
- Systematicity and comprehensiveness, emphasizing the need to coordinate the goals and results of the current, milestone, thematic and final control.
- Significance, involving the selection of the most important, key knowledge.
- The relationship of content and form as the way to reflect the content of the discipline in the test content most fully.
- The increasing difficulty of controlled knowledge.
- The optimality of the test, requiring the rigorous selection of the test contents.

It should be borne in mind that it is impossible to fully enclose the entire content of the discipline in one test, and therefore, only that basic thing is selected for the tests (especially the final control) that pupils or students should learn after studying the discipline.

Various approaches to the design, creation and parameterization of test materials are described in the works by V.S. Avanesov, M.B. Melnikov, Yu.M. Neudmann and V.A. Khlebnikov and other authors. The high skill of modern test developers is based on a deep understanding and mastering of theoretical knowledge, hardware and software, practical experience, and examination skills.

The development of quality tests is currently being conducted on the basis of reputable research teams; however, it seems that in the near future the theory and practice of test designing and creating will be mastered by teachers.

In general, when they develop and apply tests, one should rely on the rule derived from collective practical work experience: the more massive the testing, the more problems it solves, the more responsible the test procedure and result, the more likely it is to draw erroneous conclusions when poor-quality control and measurement materials are used, and therefore, in such studies it is necessary to use better pedagogical meters, processing technology, evaluation, analysis and interpretation of test results. This rule can help determine when and what tests can and should be used, what requirements should be set for tests during knowledge testing on different samples of subjects.

Conclusions

To understand the essence of modern test methods and knowledge testing technologies, assessing the level of subject training and monitoring the educational process, it is important to know the definitions of not only the pedagogical test, but also other concepts related to testing.

The introduction of correct definitions determines the sequence of fundamental concepts of design, creation, parameterizing, using tests as pedagogical meters and makes it possible to distinguish them from pseudo tests. Pedagogical meters are created from test tasks in accordance with the purpose of testing on the basis of the corresponding mathematical model that defines the information function of the test and determines the specification and structure of the proposed test.

Understanding of the educational process, its dynamic nature and timely, targeted impact on it become especially effective when they analyze the results of independent testing using standardized measuring instruments of educational achievement. This allows you to identify not only qualitative, but also quantitative changes occurring in the educational system and its individual components.

At that, in order to improve the quality of student training and the quality of education in general, it is important to analyze individual quality indicators and analyze the dynamics of changes in the educational system. In this regard, when they develop a model, it is necessary to focus on a monitoring system creation that includes a certain set of elements, procedures and subsystems.

The problem of obtaining high-quality objective information on the pedagogical activity of an educational institution is currently becoming extremely important. In the context of competition on the labor market in Russia, a social demand of information consumers is starting to form for qualified educational services provided to the population by a particular educational institution, for staff potential, the comfort of staying at school, additional educational services, the interaction of schools with universities, etc.

Educational institutions provide the opportunity to form and use various types of monitoring in their practice on the basis of independent educational statistics: didactic, dynamic, diagnostic, substantive to improve educational technology and the quality of student training.

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