INNOVATIVE APPROACHES TO ASSESSMENT IN PEDAGOGICAL PRACTICE: NEW TECHNOLOGIES, METHODS AND DEVELOPMENT OF OBJECTIVE ASSESSMENT TOOLS

ABORDAGENS INOVADORAS DE AVALIAÇÃO NA PRÁTICA PEDAGÓGICA: NOVAS TECNOLOGIAS, MÉTODOS E DESENVOLVIMENTO DE FERRAMENTAS DE AVALIAÇÃO OBJETIVA

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Abstract. The academic paper considers and substantiates pedagogical assessment by applying modern technologies as a special type of interaction between the subjects of the educational process aimed at measuring the significant characteristics of a student's activity in the course of solving tasks and problem situations, processing and analyzing the received educational information and final assessment. The model of pedagogical assessment based on using modern technologies is focused on solving the problems of objectifying the measurement process, expanding the information base of assessment, creating conditions for the formation of learning activities, including assessment activities, integrating monitoring and teaching functions, individualizing pedagogical assessment at the level of individual learning activities. The model is designed on the principles of integration of the subject-object side of assessment; optimization of criterion depth; temporal perspective; binarity; psychological safety; unity of assessment and learning activities and individualization in relation to the student. It includes the basic modules: criterion-based assessment, managing the transmission of pedagogical assessment (with a two-component information component – object-subject and subject-subject), and a module for processing the primary results of measuring students' learning activities and visualizing its results. Organizational and pedagogical conditions for implementing the model are as follows: functional completeness of information and software support; teachers' readiness to use pedagogical assessment by applying computer tools; adjustment of regulatory documents, local acts of the educational institution and protocols of service interaction, which create an opportunity to use assessment systems; creation of a motivation system that stimulates the promotion of personality-oriented education in the teaching team.

Keywords: higher education, student, educational process, pedagogical assessment, pedagogical diagnostics, academic performance.

Resumo. O trabalho acadêmico considera e fundamenta a avaliação pedagógica por meio da aplicação de tecnologias modernas como um tipo especial de interação entre os sujeitos do processo educacional que visa medir as características significativas da atividade de um aluno no curso de resolução de tarefas e situações-problema, processando e analisando o recebido informação pedagógica e avaliação final. O modelo de avaliação pedagógica baseado no uso de tecnologias modernas está focado em resolver os problemas de objetivar o processo de medição, ampliar a base de informações da avaliação, criar condições para a formação de atividades de aprendizagem, incluindo atividades de avaliação, integrando funções de monitoria e ensino, individualizando funções pedagógicas avaliação ao nível das actividades de aprendizagem individual. O modelo é desenhado nos princípios de integração do lado sujeito-objeto da avaliação; otimização da profundidade do critério; perspectiva temporal; binaridade; segurança psicológica; unidade das atividades de avaliação e aprendizagem e individualização em relação ao aluno. Inclui os módulos básicos: avaliação baseada em critérios, gestão da transmissão da avaliação pedagógica (com um componente de informação de dois componentes – objeto-sujeito e sujeito-sujeito), e um módulo para processar os resultados primários da medição das atividades de aprendizagem dos alunos e visualizando seus resultados. As condições organizacionais e pedagógicas para a implementação do modelo são as seguintes: integridade funcional da informação e suporte de software; prontidão dos professores para utilizar a avaliação pedagógica

através da aplicação de ferramentas informáticas; adequação de documentos normativos, atos locais da instituição de ensino e protocolos de interação dos serviços, que oportunizam o uso de sistemas de avaliação; criação de um sistema de motivação que estimule a promoção de uma formação orientada para a personalidade na equipa docente.

Palavras-chave: ensino superior, aluno, processo educativo, avaliação pedagógica, diagnóstico pedagógico, desempenho acadêmico.

INTRODUCTION

The objectives of the development of national education are closely intertwined with the objectives of society development. The use of information and communication technologies in education has a long tradition, both practical and scientific. However, at the current stage of digitalization of education, the significance and importance of these technologies are growing rapidly. Cloud technologies, the possibility of using artificial intelligence, significant progress in distance education, and virtual and augmented reality technologies are creating a qualitatively new environment for the educational process (Bensimon, 2020). Using modern technologies is undoubtedly one of the most advanced areas in the digitalization of the educational process.

Modern pedagogical science and world education at all levels offer a wide range of innovations: problem-based, simulation, research, game, computer, project-based, contextual and other learning models. Various forms of collaborative, group learning activities are used, and dialogic communication and interaction between the subjects of the educational process are organized. They have not had a decisive influence yet in mass education because of their incomparably lesser theoretical and methodological "equipment" compared to the traditional system of education and the insufficient technological capabilities of some of them (Jeynes, 2007). The contradictions between the orientation of the learner to the past samples of general and professional culture are defined in the educational information and the need to orient the subject of learning to the future meaning of life and activity, general and professional culture. According to the traditional paradigm, students' perceptions of the future are abstract and do not inspire them to apply knowledge in situations of complete uncertainty or in circumstances that are natural rather than contrived learning environments. Therefore, learning has no personal significance for them, and the main goal is to pass exams and tests.

At the stage of educational development, digital technologies are often used to assess students' educational achievements. There are various trends in educational practice. On the one hand, assessment is simply a matter of marking formal indicators for many teachers, and a grade is perceived as the final stage of the educational process. Using a more flexible rating system is still rare. At the same time, advanced pedagogical practice is saturated with technologies declaring the spread of unique assessment systems ("criterion-based assessment", "active grading", etc.). The connection between these technologies and more fundamental methodological concepts, such as the activity-based approach, which is a cornerstone of educational, psychological, and pedagogical science, is not usually established, even in scientific publications.

LITERATURE REVIEW

In pedagogical science, the priority of systematic study of pedagogical assessment problems undoubtedly belongs to the authorship of Black, & Wiliam, 1998. They experimentally identified the functions and types of pedagogical assessment and described their impact on the student's personality. Within the context of investigating the fundamentals and strategies for individualized learning, representatives of the scientific school of education individualization have developed their own pedagogical assessment methodology. The study of assessment as a component of learning activities, in general, has been ongoing, albeit to a lesser extent, in the works of Bikov, 2008; Gupta and Choubey, 2021; Yorke, 2003. In fact, the pedagogical assessment was studied within the framework of the activity approach (although this was not always recognized by the authors) in the studies of Hyland, 2000; Lage, Platt, and Treglia, 2000. McCarthy, & Anderson 2000, introduced the technologies of formative, criterion and active assessment in education.

The next group of surveys can be very conditionally distinguished as didactic studies and investigations of the problems of managing educational organizations and the educational process: Hattie, 2015; O'Donnell, & Topping, 1998; Singer & Emerson, 2019, are adjacent to them.

In modern pedagogy, Aragón, Eddy, & Graham, 2018; David, Nicol & Debra Macfarlane-Dick, 2006; Esposito, et al. 2017, have outlined in their works only general didactic boundaries of using assessment

technologies in a computerized information and educational environment. Foreign studies have considered only particular aspects of this issue – usually in connection with the most general problems of organizing training. There are technical and interdisciplinary studies by Davies, Morriss, & Glazebrook, 2014; Lytvynova, Spirin, Anikina, 2015; Shelukhin, et al. 2021 that examine using modern technologies in education. Actually, an interdisciplinary program of studies in the field of digital technologies that continues the investigations of the scientific school was proposed by Quaye, Harper, & Pendakur, 2020; Voznyuk, et al., 2022.

Studying the problems of assessment in pedagogy was not limited to these approaches. For instance, McMurtrie, 2021 represents a group of studies that examined the methods of monitoring and evaluation, as well as the place of control in the educational process, and a group related to studying the educational functions of assessment. Many researchers consider the process of knowledge assessment and grading as an independent activity (a type of pedagogical activity).

In addition to the works specifically devoted to assessment activities in pedagogical practice, many studies of general problems of pedagogical activity have appeared in the current period, as one of the aspects of which the assessment component is considered. These are, in particular, studies by Castle and McGuire, 2010; Grechanovs'ka, 2018; Kuh, 2008, devoted to the problems of pedagogical professionalism and pedagogical activity. For instance, Lane, R. 2019, and Polishchuk, 2012 really regard diagnostic and assessment actions to be a part of the teacher's gnostic activity without specifying them by term.

However, not all studies of the problem of assessment in the pedagogy of the period under study were related exclusively to the issues of pedagogical stimulation and the impact of evaluative judgments on the development of the student's personality.

PURPOSE

The purpose of the research is to identify the essential features of pedagogical assessment by using innovative approaches as an element of the educational process.

The hypothesis of the research is based on the following assumptions:

a) the essential features of pedagogical assessment by applying modern technologies are based on the ability to diagnose the learner's actions in assessing the situation in real-time, measuring educational outcomes, processing them and pedagogically justified presentation of the results of this measurement to the student;
b) interaction between a student and a teacher in the course of pedagogical assessment in the conditions of using digital technologies is based on pedagogical principles ensuring coordination with other elements of the educational process while expanding and strengthening the individualization of the monitoring and evaluation function.

RESEARCH METHODOLOGY (THEORETICAL BASIS)

Evaluative Feedback

The method of evaluative feedback is a form of expressing the teacher's attitude to the student's actions and the obtained results. The components of assessment activities depend to a greater extent on the author's position.

There are invariant components of the teacher's evaluation activity within the method: the definition of learning objectives, the choice of monitoring and measuring tools, and the fact of putting a mark. In addition, assessment activities may include planning, making assessment decisions; evaluating one's own assessment activities; processes of monitoring; studying the student's personality, behavior and relationships; using and implementing assessment decisions; predicting the impact of assessments on the student's behavior and personality development; adjusting assessments.

It is expedient to distinguish different groups of objectives in assessment activities, which are called levels: "immediate" ones, related to identifying educational achievements and reasons that impede the learning process; "medium" ones, related to developing a student's self-assessment based on a particular academic discipline; and "distant" ones, related to developing general self-esteem.

Method of structuring the assessment

This method determines the structure of assessment activity, taking into account, on the one hand, its functions, on the other hand, the provisions of the classical psychological theory of activity (distinguishing the motive, purpose, conditions, methods and result). The purpose of the assessment activity is to identify

and compare the achieved and planned educational outcomes over a particular time period, as well as to determine the effectiveness of the teacher's professional activity.

Pedagogical Assessment

The method of pedagogical assessment involves a process of measurement that is completed by correlation with a sample. Teaching activity has the property of internal integrity and stability, that is, the properties of the system are not reduced to the sum of the properties of its parts. According to the recommendations of the system approach, the educational process is represented by a complex system consisting of such sets: P=(p1, p2, ... pn) - teachers; B=(b1, b2 .... bm) - pupils (students); Y=(y1, y2 … yy) – educational materials; M(m1, m2 ... ml) - methodical materials. Certain relations (unary and binary) are set on these sets, which reflect the specifics of educational and pedagogical activity. Proposed models: Mp=(P, ≥) – a model of the teacher; My = (Y, ϵ) is a model of the content of educational and methodological material.

RESULTS

Components of Pedagogical Assessment

Pedagogical assessment based on using modern technologies is a special type of interaction between the subjects of the educational process and technogenic actors aimed at measuring the significant characteristics of the student's activity in the course of solving tasks and problem situations in digital technologies, processing and analyzing the information obtained, assessing the degree of achieving educational goals and students' personal development.

Our approach to pedagogical assessment is based on the traditional activity-based approach, which, in our opinion, completely provides an opportunity for theoretical reflection and scientific development of assessment systems. Real pedagogical practice as an environment in which our model is supposed to be used is quite complex and ambiguous. (Pranka, 2020) provides interesting data characterizing the actual state of pedagogical assessment in schools. The scientist demonstrates that teachers' experience was dominated by a negative assessment in the process of pedagogical interaction. The significance of the results of the scholar's study lies in the fact that the data obtained through questionnaires and data obtained through observation were compared. It should be noted that these data correspond quite closely to those shown by Souflee, & Schmitt, 1974, and this indicates that mass practice of education is quite inertial.

The use of automation tools that can be provided by computer systems and programs to a large extent is new to the modern educational reality.

The authors consider the structure of readiness for innovative activity as a combination of personal and operational aspects. The set of necessary personal and professional qualities creates the teacher's innovative potential, and expresses readiness to improve pedagogical activity (Makedon, Mykhailenko, & Vazov, 2021). However, in contrast to the scientists, we believe that reaching an innovative level of pedagogical activity requires personal comprehension; accumulation of knowledge, its transition to a higher level of systematicity, which makes it possible to see a holistic picture of the world, the manifestation of general patterns in the pedagogical process. As a result of this process, the teacher reassesses his abilities in pedagogical activities, learns new methods of activities and the cognitive component is transformed into a new form of activity with other qualitative characteristics (Barr, & Tagg, 1995). We identify the following components of a teacher's readiness for innovation in our research:

The motivational component is the necessity and desire for professional self-development in the field of innovation, and personal growth through improving the educational level in innovation. It is characterized by the teacher's attitude to the problem of the necessity of introducing innovative technologies into the educational process, a strong interest in theoretical issues, research and practical activities in the field of innovation (Spiller, 2009).

The cognitive component is the basic level and quality of knowledge, the degree of awareness of innovation issues. It is characterized by the teacher's level of theoretical, practical and methodological knowledge, the degree of mastery and the ability to operate with basic concepts, categories and patterns in the field of innovation.

The personal component includes the ability to adequately assess oneself as a personality, a professional, a subject of the educational process in the field of innovation, and creative abilities.

The activity component includes the degree of mastering skills and abilities in the field of innovation. This component is characterized by the ability to transform knowledge into practical application. In our

research, we used a comprehensive approach to conduct an examination of teachers' preparation for innovative activity by taking into account the components we had previously identified (Topping, 2021). Pedagogical diagnostics of teachers' readiness for innovative activities, being a scientific procedure, is aimed at identifying and assessing the level of readiness, and it implements the functions represented in Table 1.

Table 1. Functions of pedagogical diagnostics of teachers' readiness for innovative activities (Theobald, et al. 2020; Zivitere, Riashchenko, & Markina, 2015)

Function	Content
Evaluative	Diagnostic data allow assessing the current level of readiness development by comparing and contrasting the results achieved with the criteria and indicators that are taken as an ideal performance standard.
Predictive	Diagnostic data provide the basis for identifying reserve capacities and forecasting the innovative potential of the school collective, predicting the range of necessary competencies, teachers' personal qualities necessary for implementing innovative activities.
Constructive	Diagnostic data provide the basis for modeling the process of readiness development, predicting the range of necessary competencies, teachers' personal qualities, and the implementation of innovative activities.
Management	It ensures the organization and self-organization of developing teachers' readiness for innovative activities using diagnostic data from external and self-diagnostics
Feedback	Diagnostic data are used to adjust the process of readiness development based on analyzing the current level of teachers' readiness for innovative activities.

Combining the capabilities of computer data processing with the theoretical potential of the activity-based approach makes it possible to remove the initial contradiction between the types of assessment postulated by supporters of formative and criterion-based assessment and to organically include technical actors mediating the teacher's assessment in the model.

We proceeded from the following principles of the model being developed:

1) Integration of the subject-object side of assessment. This principle indicates the necessity of removing the contradiction between the need of taking into account the individual capabilities of each student and his efforts aimed at achieving educational goals and the organization of the educational process in accordance with educational standards.
2) Optimization of the criterion depth. This principle guides the choice of the optimal combination of the number and nature of the criteria in order to assess a particular student's learning action.
3) Temporal perspective. This principle should ensure that the assessment indicators of learning activities that have already taken place are relevant to their immediate and long-term prospects. Assessment indicators should be an additional tool for marking the track of the educational trajectory.
4) Binarity. This principle relates to the requirement of presenting the facilitative assessment delegated to the system of teachers and assessments based on the objective measurement of the accuracy of the learning task in the assessment feedback systems as independent, though connected components.
5) Psychological safety. Assessment should not traumatize the student. This should be the unity of assessment and training activities with the primacy of the latter. This principle postulates the necessity of the closest connection between these two types of activities and the fact that it should be subordinated to learning activities with a certain independence of assessment activities within the educational process (Bovill, 2020)
6) Individualization. This principle, which requires adaptation, linking, correlation of all elements of pedagogical activity with the student's characteristics, is quite well-known in pedagogy and is often used in pedagogical models. However, using information and software makes it possible to implement it in the educational process of a modern mass school.

Model of pedagogical assessment

The primary purpose of the pedagogical assessment model using modern technologies is to ensure the monitoring of students' achievement of learning objectives, as well as to stimulate their self-education and self-development.

The objectives of the pedagogical assessment model using modern technologies are as follows:

- objectification of the process of measuring the degree of achievement of educational outcomes;

- expanding the information base of the assessment by involving a large number of parameters;
- creating conditions for the formation of learning activities, including assessment activities;
- ensuring the integration of controlling and teaching functions in the educational process;
- individualization of pedagogical assessment only at the level of individual educational processes.

We have identified the organizational and pedagogical conditions for implementing a model of pedagogical assessment using modern technologies:

1) Functional completeness of information and software. The software and hardware used should not only enable the implementation of the proposed model in terms of generating modern technologies, but also ensure the implementation of all aspects of monitoring and assessment function in the pedagogical process (Salen, and Zimmerman, 2003).
2) Preparedness of teachers to use pedagogical assessment involving digital technologies.
3) Adjustment of regulatory documents, local acts of the educational organization and protocols of service interaction, which create an opportunity to use assessment systems implemented in hardware complexes of digital technologies.
4) Creation of a motivation system that stimulates the promotion of the values of personality-oriented education in the teaching staff.
5) Creation and functioning of a service infrastructure (including technical and methodological parts) that ensures the operation and use of hardware and software systems in educational institutions, designed to meet teachers' needs in a proactive manner. In connection to this principle, it should be noted that the model's success will be constrained in the absence of a developed network of technical support, not only for troubleshooting but also to help teachers become proficient users of these technologies (Kuzmin, et al. 2023).

The requirements for the value component of a professional position are among the most important ones. It is quite obvious that it is impossible to ensure the development of teachers' creative attitudes to their work and their acceptance of the model of personality-oriented learning in a short time without exception (Miège, 2000). However, it is possible to create a system that would encourage and motivate educators to do such work. Additionally, when choosing teachers to participate in the experiment, the idea of voluntary participation was scrupulously upheld.

After the selection procedure, all teachers are expected to undergo the training program. The immediate objectives of the program were as follows: to develop teachers' general theoretical understanding of the principles and methods of pedagogical assessment; to develop skills in using assessment technologies with the application of modern technologies; to master basic knowledge and skills about the features of individual styles of students' learning activities; to form an idea of the possibilities of criterion-based assessment. In addition to the above sections, the course was intended to stimulate teachers' professional reflection in the field of pedagogical assessment and to develop highly specialized skills: defining the subject of assessment, its criteria; the ability to organize communication with students in connection with assessing their learning activities (Dobroskok, Kotsur, Nikitchyna, 2008).

When studying the section "Psychological and Pedagogical Principles of Organizing the Educational Process", the emphasis should be on familiarizing teachers with modern pedagogical technologies and analyzing them within the framework of theoretical concepts accumulated by modern pedagogy and psychology. The primary focus was on developing the ability to separate information about pedagogical technologies as a franchise related to their advertising from scientific and pedagogical assessment (Gruenewald, 2003). In addition, an understanding was formed among teachers that assessment activities, despite their specificity, should be analyzed and organized in the context of learning activities and the educational process as a whole.

Next, the mechanisms of assessment that influence the mental state and development prospects of the student were studied. The pedagogical technology used in this section was a combination of students' independent work and collective analysis of essays and reports.

We do not use the term "teacher's assessment activity involving digital technologies" because, in fact, in the process of assessment by applying digital technologies, the teacher's own activity and the actions of computer applications are closely intertwined, which, in our opinion, does not allow the use of the term "activity" since it implies the presence of a subject.

The subject of our research does not include the technical aspects of developing the described complexes; however, the general logic of organizing the assessment, which corresponds to the logic of the information system, is an essential part of the model (Luxton-Reilly, 2009).

The model assumes that the information and software complex supporting the implementation of the curriculum objectives includes a diagnostic unit, that is, it provides information on a fairly large list of formalized criteria. We have grouped them into two categories: outcome criteria and process criteria. This is a traditional division of criteria used by numerous authors. Depending on the specifics of the academic discipline, some criteria were mandatory, and some were variable (Kukulska-Hulme, 2022).

- The group of outcome criteria should include:
- the results of fulfillment or non-fulfillment of the task (mandatory);
- optimality of the choice of the solution route (variable).
- The group of process criteria should include:
    - total time of the decision (mandatory);
    - time spent solving each stage of the task (variable);
    - the number of returns (variable)
    - the number of requests for tips (variable).

All the information on the above criteria was available to the teacher in correlation with the average values for a particular student and with the average value for the entire sample of students who solved this task.

The primary result is the scores for the successful completion of the task. The total number of scores could include several process criteria (configured by the teacher), such as the number of requests for tips or the time to solve (these functions naturally had feedback to the result) (Baida, Mironov, & Miatenko, 2022).

The system calculated coefficients based on the data obtained to assess the style aspects of the student's learning activities in those disciplines where the subject material allowed, in particular:

- assessment on a scale: "fast – slow";
- assessment on the scale "type of solution": "random search", "template solution", "non-standard solution".
- assessment on the scale "attentiveness and ability to concentrate".

It is assumed that the presence of such generalized markers will allow the teacher to use pedagogical assessment more accurately.

The second major element of the proposed model was a module for managing the transmission of pedagogical assessment. Our standpoint, which we have justified above, is that it is impossible to separate two components – the teacher's subjective assessment, focused on the whole range of factors of the pedagogical situation of development, and the assessment of the student's educational outcome in the real process of pedagogical assessment. In this regard, we have provided a two-element information component in reporting the grade, which is displayed to the student after completing the assignment. This particular feature of the model is the implementation of the binarity principle and the integration of the subject-object side of assessment due to the possibility of adjusting the message in which the student is informed about the grade (score, numerical value corresponding to the degree of completion of the assignment) by including an assessment part aimed at supporting and stimulating his personal development (Andrade, Bennett, and Cizek, 2019). Despite an incorrect solution, the teacher can praise the student, and when using our model, he can configure the software package so that this praise is generated automatically for a certain type of task and particular solution parameters.

The first component was related to the object-subject assessment and reported on the extent to which the student managed to complete the task (solved it), and the second component was related to the subject-subject assessment and reported the student's evaluative attitude to the teacher (Mosol, 2022).

Both components were supported by emoticons reflecting emotional attitudes. In addition, the assessment scales of the second component could be independently adjusted to take into account the effort expended by a particular student, his progress in mastering a particular topic, the degree of motivation, emotional vulnerability, and other factors that the teacher considered significant in this assessment situation.

Use of the evaluation model in practical conditions

Within the framework of the activity-based approach, which we have defined as the methodological basis, the choice of the main criteria is quite obvious: the nature of the motivation for learning activities, the level of achieving educational outcomes provided by the program, and the adequacy of self-assessment. The correspondence of criteria, indicators and diagnostic tools is represented in Table 2.

Table 2. Correspondence of criteria and indicators for diagnosing the effectiveness of pedagogical assessment

Criterion	Indicator	Method of diagnostics
The nature of motivation of students' learning activities	The level of formation: broad cognitive motives *Mg*; actual cognitive motives of learning *Ml*; The motive of self-development (personal motives of learning activities) *Mp*	Relevant scales of the methodology for diagnosing the motivation of learning activities
Level of achievement of educational outcomes	The level of current academic performance ( ). The score for conducting verification works during the interim certification (APr)	Assessing the success of students' answers based on a specific bank of questions. Assessing the performance of test work on particular sections (topics of the educational program)
Adequacy of self-assessment	Correlation of students' preliminary assessment and real assessment *(SE)*	A subjective forecast of the future assessment, indicating problem areas of preparation. Comparison of the obtained forecast with the real one.

As a result, two large groups of motives are distinguished: the first is motives related to learning activities; the second is motives related to the broader social context in which the activity takes place. It should be noted that we did not use the data obtained from the three scales in our research, namely, the groups of motives related to the social motivation of learning activities.

We use the following scales in our research:

Broad cognitive motives. The high values obtained on this scale demonstrate that the subjects are focused on acquiring new knowledge, mainly related to the laws and essential phenomena of the surrounding reality. These are actually cognitive motives of learning (educational and cognitive motives).

High scores on this scale demonstrate students' desire to master the ways of independent knowledge acquisition, orientation to self-regulation of learning activities. Motives for self-development or personal motives for learning activities. This scale measures the degree to which the subjects are focused on improving their own ways of acquiring knowledge.

The subject receives from 0 to 4 "raw" scores for each scale. We normalized these results (as well as the rest) to a 100-point scale. The experiment evaluated both the final index of cognitive motivation (the arithmetic mean of the three indicators) and each of the indicators separately. A bank of questions and tasks for each topic was compiled in order to reduce the influence of subjective factors on the assessment. We organized the work of a group of subject teachers who compiled a list of questions and tasks that teachers could use to assess current performance.

The final grade of academic performance (AP) was calculated as the average of two indicators (AP^c) and (AP^r), but we used weighting factors in the formula:

$$AP_i = \frac{0,8AP_i^c + 1,2AP_i^r}{2} \quad (1)$$

where APi – is the academic performance index (in certain subject areas) of the i-th student, AP_i^c – average values of the current academic performance of the i-th student (normalized to a 100-point scale), AP^r – scores obtained by the student.

For measuring the adequacy of self-assessment, we decided to use the student's ability to predict his performance on a test. Technologically, it looked as follows: about a week (6 to 10 days) before the test, each student was asked to name the grade he would receive for the test and indicate the sections (topics of the material) in which there would be most mistakes. If the student believed that he had mastered these

sections well, then this part of the answer was left blank. The self-assessment adequacy indicator was calculated as the difference between the predicted and obtained scores; in addition, when calculating it, the correctness of the indication of "problem areas" was taken into account (the correctness was assessed by the teacher when verifying each work – the percentage of correspondence between the prediction and reality was calculated):

$$SE_i = (100 - \frac{\left(x_i^r - x_i^p + y_i\right)}{2} \quad (2)$$

where SE_i – is the index of adequacy of self-assessment in the field of educational activity for the i-th student, x^r_i – the score obtained by the i-th subject for the test work, x^p_i – the score indicated in the prediction of the i-th student, y_i – the percentage of discrepancies between the areas (sections) of the academic discipline that the subject indicated as problematic and those in which he made significant mistakes.

The sample size and its allocation among students of different academic disciplines and educational organizations (Table 3) make it possible to consider it representative.

Table 3. Allocation of subjects by academic disciplines and educational institutions

Educational Institutions	Academic Disciplines						
	Discipline 1		Discipline 2		Discipline N		Number of Scores
1							
2							
N							

All the settings in the assessment system could be set by the teacher in advance, but could also be adjusted at any time. If necessary, the teacher could use text (or audio) messages (depending on the type of test module) to directly contact the student (Mayhew, et al. 2016). When using the proposed system, the teacher can receive information in real-time and in a delayed mode about the results and progress of completing tasks and problem situations by students in a given amount. The amount and specification of this information can be arbitrarily configured by the teacher. The teacher also has the opportunity to adjust the system's automatic assessment responses for each student (provided that the possibility of direct communication with students is maintained).

RESULTS OF THE EVALUATION EXPERIMENT

The data obtained during the pedagogical experiment are presented in Table 4.

Table 4. Average values of the main indicators at the initial stage of experimental work

Indicators / Groups and disciplines	Indicators / Groups and Disciplines				Indicators / Groups and Disciplines			Indicators / Groups and Disciplines
	Mg	*Ml*	*Mp*	*M*	*APc*	*APr*	*AP*	*SE*
Discipline 1								
Control group	59,31	52,12	49,64	53,69	82,35	70,92	75,50	62,88
Experimental group	59,92	53,75	46,89	53,52	83,99	68,17	74,50	63,04
Discipline 2								
Control group	49,81	53,47	45,34	49,54	66,90	55,42	60,01	58,60
Experimental group	49,45	53,19	43,44	48,69	66,62	53,52	58,77	57,78
Discipline 3								
Control group	51,96	54,66	45,72	50,78	72,56	58,04	63,85	60,26
Experimental group	50,68	54,85	48,53	51,35	72,76	60,84	65,61	61,32
Discipline 4								

Control group	55,43	57,60	49,61	54,22	75,83	62,14	67,62	63,68
Experimental group	57,54	58,76	49,45	55,24	76,98	61,99	67,99	64,39
Discipline 5								
Control group	43,33	42,53	49,31	45,05	60,76	61,83	61,40	53,52
Experimental group	41,50	42,12	50,24	44,62	60,35	62,77	61,80	53,56
Discipline 6								
Control group	61,58	59,32	60,81	60,57	73,11	71,16	71,94	67,87
Experimental group	61,32	59,04	63,61	61,32	72,84	73,97	73,52	68,62
Discipline 7								
Control group	56,84	73,59	52,36	60,93	98,73	79,97	91,47	80,32
Experimental group	56,98	72,35	47,71	59,02	97,93	75,31	88,37	77,95

Note. Mg - the value of the "broad cognitive motives" scale; Ml – the value of the "educational and cognitive motives" scale; Mp - the value of the "motives of self-development" scale (personal motives for educational activity); APc - level of current success; APr - the score for the performance of verification work during the intermediate attestation; SE - adequacy of self-assessment of educational opportunities; AP - final assessment of academic performance; M is the final assessment of the formation of educational motivation.

Because we cannot rule out the specifics of each academic discipline, it was decided to analyze each discipline separately. The distribution is close to normal in all disciplines, and the formation of students' educational motivation fluctuates around the average values (from the minimum – 42.12 (Discipline 5) to the maximum – 98.73 (Discipline 7). A similar analysis was carried out for educational achievements. Recall that for a more adequate perception of the results, all primary data were translated into a 100-point scale, i.e. marks "2", "3", "4", and "5" were assigned other values, determined as the average rating of teachers who used the 100-point system (there were about 40% of such in our study.) The ratio turned out to be non-linear: "2" - 20 points, "3" - 45 points, "4" - 70 points, "5" - 100 points.

The results show that the distribution of marks (taking into account the current academic performance and the results of the test) turned out to be normally distributed. The distribution of the main parameters had the character of a normal distribution and generally corresponded to the idea of an average participant of the experiment - a student who does not fully adequately assess his educational opportunities, makes significant mistakes in assessing his educational prospects, difficulties and successes, manages to get "good", although sometimes he also receives rating "satisfactory", has a significantly different motivation to study different academic disciplines and not fully formed general cognitive motivation.

Thus, as a result of implementing the proposed model, the assessment of students' learning activities becomes individualized, objective and can be carried out with varying degrees of involvement of the teacher himself. Thus, it becomes possible to overcome objective limitations and achieve the features of individualized education systems in the conditions of mass schools and lesson-based organization of education.

DISCUSSION

Our opinion is that the pedagogical characteristic of pedagogical assessment is influenced more by the fact that digital technologies typically have built-in systems not only for diagnosing results but also for completely recording every aspect of the subject's behavior than by the phenomenon of immersiveness. Additionally, as all of these systems are still programmed by people, a man-made actor (program) becomes the source of assessment on the one hand, and a teacher on the other hand. This situation makes it possible to further individualize the learning process, including the process of examining learning progress, and, at the same time, it creates certain difficulties. The possibilities of individualizing assessment should be based not only on the technical capabilities of educational systems but also on relevant theoretical concepts, the basis for which, in our opinion, is the study of students' style features. Regarding the goal of our research, we concluded that it is crucial to prioritize formal and dynamic markers of the cognitive process when assessing an individual method of completing a given task. Using the opportunities provided by educational technologies, while maintaining all the previously existing features of pedagogical assessment (for instance, the ability to correlate it with the process or the result of performing a learning activity), allows the teacher to expand the scope of pedagogical assessment to areas that were previously inaccessible to him, and make it truly real and objective.

CONCLUSION

Based on the conducted analysis, we define pedagogical assessment by using modern technologies as a special type of interaction between the subjects of the educational process and technogenic actors. It is aimed at measuring the significant characteristics of the student's activity in the course of solving tasks and problem situations by applying digital technologies, processing and analyzing the information received and detailed messages about the measurement results.

The model of pedagogical assessment by applying modern technologies proposed by us is based on several principles: integration of the subject-object side of assessment; optimization of criterion depth; temporal perspective; binarity; psychological safety; unity of assessment and learning activities with the primacy of the latter; individualization; object-subject and subject-subject and a module for processing the primary results of measurements of students' learning activities and visualization of its results.

Organizational and pedagogical conditions for implementing the model are as follows: functional completeness of information and software support; preparedness of teachers to use pedagogical assessment by applying digital technologies; adjustment of regulatory documents, local acts of the educational organization and protocols of service interaction, creating an opportunity to use assessment systems; creation of a motivation system that stimulates the promotion of personality-oriented education in the teaching staff; creation of a service infrastructure designed to meet teachers' needs in a proactive and forward-looking manner.

The criterion block on which the model is based is formed, including the following criteria: outcome (results of completion or non-completion of the task (invariant, mandatory), optimality of the choice of the solution course (variable) and process (total solution time (invariant, mandatory), time spent on each stage of the task (variable), and a number of returns (variable). The block of processing and visualization of results, in addition to the ability to review all the primary information, gave a score on a scale: "fast – slow" (invariant), "attentiveness and ability to concentrate" (invariant), "type of solution" (variable). The model proposed by us suggests the possibility of its use within different academic disciplines, thereby providing a wide variety of partial methodological solutions.

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