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N.A. BAIZHANOV

National Testing Centre Ministry of Higher Education and Science RK (Astana, Kazakhstan)
**e-mail: nurseit.baizhanov@testcenter.kz*

CONCEPTUAL APPROACHES TO MANAGING AN ANALYTICAL SYSTEM IN THE FIELD OF EXTERNAL ASSESSMENT OF EDUCATION QUALITY

Abstract

This article proposes an innovative idea for the development of a new information-analytical system in the field of external assessment of education quality (competencies) using Artificial Intelligence (AI) and Big Data (BD). This system represents an innovative approach to the external evaluation of education quality, covering various levels of assessment from individual learners to the national level. The system aims to use AI and BD technologies to enhance the objectivity, and reliability of assessments, and provide a broader coverage of students and educators. The system's architecture includes various modules, each designed to address specific aspects of external evaluation, such as education quality, teacher competence, psychodiagnostics, and career guidance, with the innovation of this system lying in the comprehensive interaction of these modules. The implementation of this system is aimed at improving education management and building individual learning trajectories by tracking the dynamics and history of educational achievements. This will also ensure transparency in decision-making, reduce the level of corruption, and create equal educational opportunities for different regions and population groups.

Keywords: external assessment, artificial intelligence, management in education, teacher certification, psychodiagnostic, career guidance.

Basic provisions. The current research addresses conceptual approaches to the development of an analytical system in the field of external education assessment, as a mechanism of management in education. The study acknowledges the existence of insufficient student assessment methods. The existing assessment methods (EVEA and MEDA) are analysed and this research makes recommendations on how to improve the assessment method using Artificial intelligence tools (AI). These are External assessment of the quality of education and monitoring of the individual educational trajectory from primary school to obtaining a specialty/qualification; Generation of test questions for students using AI technologies; External Assessment of Teacher Competence Using AI and Database Technologies; Data Analysis and Recommendation Generation for Students, Teachers, School Administrators, and Education Authorities Using AI and Database Technologies; Psychodiagnostics of Students and Teachers Using AI and Database

Technologies; Career Guidance for Students Using AI and Database Technologies.

Introduction. In today's world, where the job market and educational standards are constantly changing, there is a need for a more precise and adaptive system of competency assessment to prepare modern, qualified professionals. Currently, there is no comprehensive assessment of a learner's competencies that considers the 21st-century skills necessary for success in education and career: critical thinking, creativity, collaboration, communication, digital literacy, problem-solving skills, adaptability, and cultural awareness (Thornhill-Miller et al., 2023).

The assessment of these skills lies at the intersection of educational, psychological, physiological, and career guidance measurements of the learner's condition, yet such a comprehensive assessment is not yet available. Moreover, the comprehensiveness of a learner's assessment is closely related to the assessment of a teacher's competence. Identifying the correlation between these assessments will help in developing the most successful strategies for teaching, self-education, and professional development of teachers, as well as educational policy and management (Zawacki-Richter et al., 2019).

In general, the quality of education is currently assessed in its directions without a comprehensive approach and without considering other factors affecting the success of learning: demographic, cultural, and regional characteristics of the learner, their educational environment at the level of family, school, neighbourhood, district, region. The educational and psychological interaction of the learner with other classmates, peers, and their activity on social networks is not considered. A comprehensive analysis of the results of educational and psychological assessment in practice is not linked to recommendations for career guidance for the learner, choosing schools and universities for further development of their abilities.

Moreover, there is no systematic monitoring of the results of the educational achievements of each learner, taking into account and analysing the above-mentioned factors of the educational environment. There is no consistent history of assessing educational achievements, starting before the beginning of the first grade and ending with the acquisition of a specialty in university. Using the history of education based on regular and adaptive assessment of the specific learner in their natural environment will allow a clearer view of the learner's weaknesses and strengths than conducting standardized tests. It will also help predict the success of their education and develop more effective recommendations for learning and self-learning. Considering the large volume of work, the use of modern Artificial Intelligence (AI) and Big Data (BD) technologies is required to accomplish the aforementioned tasks. The use of AI and BD technologies to assess educational achievements and professional skills is a trend capable of radically transforming approaches in education and assessment (Hinojo-Lucena et al., 2019).

The use of AI to create adaptive tests and personalized curricula, which automatically adjust to the knowledge level and learning speed of each learner, is a cutting-edge practice (Yang et al., 2021). Traditional assessment methods are often subject to subjectivism and do not always take into account the individual characteristics of the learner. With the wide possibilities of AI, it is possible to ensure a more objective and personalized assessment (Boverhof et al., 2024; Misiejuk, Kaliisa & Scianna, 2024; González-Calatayud et al., 2021).

The development of a complex multi-level system (student/teacher – class/group – subject/specialty – school/college/university – district – region – country), which integrates data at different levels-from individual students to entire educational institutions and regions, represents a new approach in the field of educational analytics. Currently, a large amount of data accumulates in the databases of the National Testing Centre, which is not fully utilized in analysis and decision-making. Existing methods of knowledge assessment are also not sufficiently objective and comprehensive. Considering the development of technologies and their capabilities, it is possible to create a Multi-level Information-Analytical System in

the field of external assessment of education quality and competencies (student/teacher – class/group – subject/specialty – school/college/university – district – region - Republic) using AI and BD technologies (hereinafter referred to as the System). This System will allow assessments to be conducted based on machine learning algorithms by processing a massive array of objective data in a short time, ensuring comprehensive coverage, higher reliability, comprehensiveness, and objectivity of assessment results.

The introduction of analytical systems based on AI and BD will optimize the educational process, automatically adapting materials and methods to the needs of each learner. Also, the use of AI will allow the analysis and processing of various types of data, including text responses, test results, and video and audio materials, which is an innovative approach to competency assessment.

Materials and Methods. As noted earlier, the most effective assessment of a student's competence and 21st-century skills occurs at the intersection of academic, psychological, and career guidance assessments. The correlation of these with the evaluation of the teacher's work, as an active participant in the educational process, is also crucial. Thus, a comprehensive assessment of a student is based on the study, analysis, and evaluation (implementation) of the following parameters:

–the academic results of the student;

–analysis of their correlation with the quality of the teacher's work;

–generation of adaptive test assignments for the student;

–psychodiagnostics of the student and teacher to identify factors hindering or facilitating educational goals;

–assistance in choosing a future profession (career guidance) to most effectively realize potential;

–development of necessary recommendations and monitoring their implementation.

These directions should form the basis for the creation of the proposed System. To develop conceptual approaches for creating the System, it is necessary to analyze the current state of the aforementioned assessment directions in education.

Firstly, the development of an understanding of its conceptual foundation is necessary-the main idea of a unified and consistent monitoring program (external assessment) of educational achievements. In many developed countries, national education quality monitoring systems operate (Kobenova, 2021). These systems are based on centrally developed assessment forms that are conducted among various student groups, primarily in secondary education, at certain stages of school education. This process of external assessment is used to analyze educational achievements and serves as a basis for making decisions to improve educational policy.

In Kazakhstan, one of the key external assessment programs in the field of secondary education is the Monitoring of Educational Achievements of Students (MEDA). This monitoring began in 2021. The MEDA program in Kazakhstan covers students in the 4th and 9th grades. It consists of comprehensive testing in three areas of functional literacy: mathematical and science, as well as reading literacy (Analiticheskiy Otchet, 2022).

MEDA is designed for systematic observation of the quality of education among primary and secondary school students through testing, using tasks similar to international educational studies such as TIMSS, PISA, and PIRLS. In addition to schools, MEDA is also conducted in colleges as comprehensive testing in 4 subjects for second-year students in subjects "History of Kazakhstan", "Mathematics", "Kazakh language" or "Russian language" and one specialized subject ("Biology", "Physics", "Chemistry", "Geography") (Shilibekova, 2021).

The Unified National Testing (UNT) is also used for external assessment of educational achievements. This standardized testing is taken by high school graduates for university admissions. Within the UNT in Kazakhstan, three mandatory subjects are tested ("Reading Literacy," "Mathematical Literacy," and "History of Kazakhstan"), plus a combination of two specialized subjects chosen by the

applicant according to an approved list (there are 12 combinations, the most popular being "Mathematics-Physics", "Biology-Chemistry", "Mathematics-Computer Science"). The choice of combination depends on the future specialty the applicant wishes to pursue.

The results of the UNT in Kazakhstan are used not only to assess the knowledge of applicants and award them grants but also for analysis and decision-making at various levels of the education system. The outcomes of the UNT are analyzed at the school and regional levels to assess the quality of education programs, based on which changes are made to educational policy, curricula, teaching methods, and the State Education Standards. They are also used to analyze and develop strategic documents at the regional and national levels to most effectively distribute and manage labour, financial, and other resources.

The development of UNT tests includes several important stages. Based on the approved specification of the test task by the I. Altynsarin National Academy of Education for certain subjects, experts develop questions that should adequately reflect the level of knowledge required of high school graduates. After the tasks are created, they undergo a review process by other experts and are tried among students to check their reliability and validity. This stage also helps determine which questions might be too easy or difficult. Based on the results of the trial, test tasks are adjusted to eliminate any discrepancies and to ensure their clarity and accuracy of phrasing. Tasks that have passed all stages of checks and adjustments are compiled into final test versions. All tests are strictly confidential and stored with necessary security requirements. UNT tests are not adaptive; every student receives the same amount of time and the same set of questions for each subject, despite different test variants.

In addition to the aforementioned forms of external assessment, there are other forms of student knowledge assessment (internal forms of assessment), such as ongoing monitoring of performance, and midterm and final student assessments. However, these are essentially internal assessments of education quality and are not covered by the subject of this article.

It should also be noted that there are other forms of external quality assessment of education in the form of inspections of educational organizations for compliance with qualification requirements conducted by authorized state bodies, licensing, and accreditation. However, they relate more to the management of the education organization, not to the assessment of the quality of knowledge and skills of specific students.

Considering modern trends in technology, there is significant interest in using AI to create test tasks. This helps save considerable labour, and time for teachers and enhances the quality of pedagogical measurements of students' competence. Currently, various platforms offer innovative solutions for automating the process of developing test tasks using AI.

One of them is PrepAI (n.d.). This platform provides an AI-based generator for tests and other assignments. This tool uses natural language processing and machine learning algorithms to automatically generate questions based on a given topic or content, and it can create them in the form of exams, quizzes, and test assignments. According to information from this portal, this program allows educators to quickly create questions, including complex ones based on Bloom's taxonomy for assessing students' critical thinking.

This portal presents a specific case at one of the leading universities in India. At this university, teachers spend a large amount of time preparing quality questions for exams. Therefore, they had less time for other educational and methodological issues (preparation of lectures, additional materials, consultations, or interaction with students). Moreover, year after year, professors used the same test questions for several years, which reduced their value in terms of the reliability of results.

To solve this problem, the university implemented PrepAI (n.d.). According to the portal, this allowed professors to save 71% of their total time, and create a more diverse and interesting question template, which in turn

led to an approximately 59% improvement in student performance. Furthermore, it provided the ability to more effectively assess student knowledge, leading to a 31% increase in students achieving their learning goals.

There are also other programs. The Testportal (n.d.) offers AI capabilities for automatically creating quizzes, tests, and exams from provided textual content. The platform allows users to input documents, and based on these, AI generates corresponding questions and answers, which can then be customized. OpExams (n.d.) offers a free AI-based question generator that can produce multiple-choice, true/false, and open-ended questions from any text. This helps educators quickly and effectively create assessments, with the ability to save and organize generated questions for future use.

These tools demonstrate the growing trend of using AI for educational assessment activities. AI is significantly changing the approaches to creating and conducting testing in education, turning it into a dynamic and adaptive process with significant reductions in labor and time resources spent.

An important component of the System should be the assessment of teacher competence. The teacher is a central link in ensuring the quality of education. Therefore, their assessment linked with the educational achievements of the student is crucial. External assessment of teacher competence in Kazakhstan is conducted as part of the certification procedure. This issue is regulated within the framework of the Rules and Conditions for Conducting Teacher Certification, approved by the Order of the Minister of Education and Science of the Republic of Kazakhstan dated January 27, 2016, No. 83 (hereinafter – Certification Rules).

Based on the results of positive certification, teachers are assigned qualification categories such as 'teacher', 'teacher-moderator', 'teacher-expert', 'teacher-researcher', and 'teacher-master'. According to the Certification Rules, certification occurs in several stages. For admission to certification, the educational organization conducts a qualification assessment of teachers by reviewing the teacher's portfolio. The qualification assessment is carried out by the educational organization based on the assessment of materials (portfolio) of the teacher for compliance with qualification characteristics. The portfolio includes the teacher's essay, as well as a commission assessment of the teacher's work in ensuring the quality of education (commission assessment of the dynamics of mastering the educational program of the class for the last three years), in summarizing and transmitting advanced pedagogical experience (transmission of author's materials recommended by the methodological council, presentations at various seminars, forums, participation in professional development as a mentor, publications of research materials in certain publications, etc.), based on existing achievements in teaching (certificates, diplomas, letters of appreciation, etc.), and results of their professional development. Each indicator is given certain points on a scale (Certification Rules).

After admission to certification, the teacher participates in testing or the Assessment of Teacher Knowledge (ATK). Typically, it consists of 50 questions that relate to 2 types of directions depending on the work performed by the teacher. It may cover "Subject Knowledge", "Teaching Methodology", "Fundamentals of Pedagogy", "Fundamentals of Psychology", "Special Pedagogy and Psychology", and "Preschool Pedagogy and Psychology", among other things (Certification Rules).

When achieving the threshold level in ATK (depending on the claimed category, the level ranges from 50 to 90 percent of correct answers), educators undergo a comprehensive analytical summary of the results of their activities, that is, an evaluation by a specially created commission for compliance of the existing evidence of activity and achievements of the teacher with the requirements of the teacher's qualification category. Recently, changes have been made to the certification process in Kazakhstan, particularly for teachers with 30 or more years of experience, who are now exempt from mandatory testing and undergo only a portfolio assessment. Certification is conducted no less than once every five years, and teachers

can use the results to advance their qualification category (Certification Rules).

An important factor in the success of education is the monitoring of psychological health. Therefore, this area of external assessment is an important component of the proposed System. In Kazakhstan, the monitoring of mental health in schools is carried out through psychological services. The psychological service is a collegiate body of the secondary education organization for forming study motivation, performance, creative self-realization, stabilization of psychological state, professional self-determination, and other favourable conditions for the educational activities of students and trainees. Typically, the psychological service includes the school's deputy director, educational psychologist, and social educator. Also involved in the work are class teachers and medical staff who participate in the psycho-pedagogical support of students. The activities of these services are regulated by the Rules of the Psychological Service in Secondary Education Organizations, approved by the order of the Acting Minister of Enlightenment of the Republic of Kazakhstan dated August 25, 2022, No. 377 (hereinafter – Rules of the Psychological Service).

According to these rules, the educational psychologist conducts activities related to psychological diagnostics, consulting, development, and correction of the psychological state of students, psycho-pedagogical enlightenment, as well as organizational and methodological work within their competence.

According to the Rules of the Psychological Service, the diagnostic direction of the educational psychologist should cover issues related to the study of individual characteristics and inclinations of the student, his potential opportunities in learning, and professional self-determination. In the course of this work, the educational psychologist conducts consultative work with students, their educators, and parents, helping them understand the reasons for emerging difficulties, solve psychological problems, and facilitate their self-development.

The developmental (corrective) activity of the educational psychologist should be aimed at forming motivation for new knowledge, skills, and abilities for educational and cognitive activities. Such work is conducted in cooperation with subject teachers, social educators, and special educators. Achieving the goals set before the educational psychologist is aided by psycho-pedagogical enlightenment in the form of class hours, seminars, parent meetings, pedagogical councils, interactive methods, and lectures for educators and parents (Rules of the Psychological Service).

Besides this, the educational psychologist conducts monitoring of the educational and developmental environment and analyses the results of social and psycho-pedagogical support. Based on these results, necessary recommendations are developed (Rules of Psychological Service).

Directly linked to the psychological aspects of education, student motivation, and their further success in learning and career, are the issues of career guidance. In Kazakhstan, the system of career guidance in schools is built around comprehensive support for students in choosing a future profession (Profone, n.d). This includes introducing students to various professional fields and assisting in identifying their inclinations and interests. Career guidance work in schools includes consultations with specialists, undergoing career orientation tests, and organizing meetings with professionals from various fields. Schools also collaborate with universities and enterprises. This allows students to receive current information about professions and their prospects in the job market.

One of the advanced practices of career guidance is available in the network of Nazarbayev Intellectual Schools (Ruby & McLaughlin, 2014; Nazarbayev Intelektualnye Shkoly, n.d.). In NIS, career guidance work is carried out from grades 7 to 12 according to the Rules for conducting career guidance work in Nazarbayev Intellectual Schools, approved by the decision of the JSC Board on 13.12.2018. As part of career guidance, the professional orientation of each student is diagnosed based on Klimov's Career Guidance Test, Holland's Method of Professional Self-determination, Golomstock's «Interest Maps» and 'Interest

Maps' for specific subjects. Assistance is provided to students considering their potential matched with the requirements demanded by individual professions.

The matching is achieved through the interaction of five elements of educational activity: academic activities, psychological support, extracurricular activities, interaction with parents, and career guidance work itself. When analysing academic activities, the results of tests, elective courses and clubs, olympiads, competitions, projects, specialized subjects, and career orientation events on subjects are considered. During psychological support, various tools (tests, discussions, observations, etc.) are used, and the degree to which a future profession integrates with the individual's overall personality system is determined. This integration is crucial as it serves as the primary psychological driver of professional development. In extracurricular activities, various forms are used: Smart Thursday - meeting with various professionals, assistance from teacher-librarians in selecting literature based on interests, participation in clubs and circles of interest, debates, tutor hours, summer schools, social and professional practices. In these activities, parents, subject teachers, psychologists, and career advisors are actively involved in various forms. The main goal of these activities is to ensure a clear understanding of the world of professions, competencies, and requirements of the chosen profession, to define short-term and long-term goals for its attainment, and to develop on this basis an individual route for the student and monitor its implementation. These activities allow students to gradually form an understanding of their professional interests and abilities, as well as to effectively plan their further education and career.

Various online platforms also provide significant assistance in career guidance. For example, on the EduNavigator platform, students can undergo testing to determine a suitable profession. This process includes receiving a detailed report on personal qualities and suggestions for choosing a profession.

Many centers, such as the Center for Career Guidance and Counseling in Almaty (CCGC), offer personalized career counseling and detailed personality testing that helps students identify their strengths and possible directions for career development. Considering the important role of parents in career guidance, this platform also consults parents to better support their children in choosing a future profession. Professional consultations at this center often include analysis of candidates' creative works and assessment of their abilities. This significantly helps children make a more informed choice of profession. Thus, the system of career guidance in Kazakhstan is somewhat developing and adapting to modern conditions through the integration of digital technologies and strengthening the links between school education and the job market.

Overall, it should be noted that the above-mentioned parameters for student assessments develop with insufficient interconnection and correlation among themselves. Additionally, using a comprehensive approach would allow for a more complete picture of student's knowledge and skills and the prospects for their further enhancement, explain learning difficulties, and more effectively uncover latent personal potential. Moreover, the current state of the external assessment system for student competence has several conceptual flaws that need to be considered when developing and implementing the system. These will be discussed below.

Results. The system of selective monitoring of educational achievements existed before the creation of MEDA. In 2005, to implement the State Program for the Development of Education in the Republic of Kazakhstan for 2005-2010, the procedure for Interim State Control (hereafter - ISC) was established to monitor the quality of students' mastering of educational programs at corresponding levels and stages. It covered selective monitoring among students in the 4th and 9th grades (according to the list of subjects determined by the relevant ministry), and among students in the 2nd (3rd) year of higher education institutions (for disciplines included in the cycles of social-humanitarian, natural sciences, and general profile disciplines). ISC was conducted to

perform an external evaluation of students' academic achievements, and the effectiveness of the educational process organization, and to develop necessary recommendations.

Subsequently, ISC was replaced by the system of External Evaluation of Educational Achievements (EVEA). It was also conducted selectively in the form of comprehensive testing for two or more subjects, determined by the authorized state body, in primary school (4th grade), basic school (9th grade), and general secondary school (11th grade). In the sphere of higher education, EVEA was conducted among third-year students in selected organizations by the authorized state body to monitor the mastering of typical educational program cycles.

The cancellation of EVEA in Kazakhstan was due to several reasons. One of the main reasons was the need to adapt the system of external evaluation to international comparative studies in the field of education quality assessment and contemporary educational quality standards. According to the OECD, it is important to focus on developing competencies necessary for the successful integration of graduates into society and the economy, not just on theoretical knowledge (OECD, 2021).

The existing EVEA system was criticized for not fully reflecting the actual quality of the educational process and could negatively impact the motivation of students and teachers, focusing attention on preparing for tests rather than learning (Shilibekova, 2021).

Moreover, another reason for the cancellation of EVEA was voiced by the then Minister of Education and Science, Sagadiyev (in Informburo.K. Z., 2019), who stated, "There is no need for EVEA in universities, as with the current level of academic freedom in universities, there is no longer a need for EVEA".

Considering this, the MEDA system was introduced instead of EVEA. This system was discussed earlier. However, MEDA does not fulfil all necessary tasks to ensure the successful acquisition of necessary competencies by students.

The main reason is the selectivity of the assessment and the absence of monitoring the entire education system. MEDA is conducted for specific classes only in secondary and specialized secondary education. It is not conducted in the higher education system. Moreover, MEDA covers only a small portion of educational institutions. MEDA was first conducted in 2021, and its results were summarized in 2022. According to state data, in 2022 there were 7,687 schools in Kazakhstan (GOV.KZ, 2023). MEDA was conducted among 4th grades in 1,441 schools and 9th grades in 1,182 schools. Thus, MEDA covers 15 to 20% of schools in the country.

It must be noted that MEDA is conducted using information and telecommunication technologies. This requires certain material resources in schools. Such resources are not available in all schools. Even considering the rotation of MEDA participants, several schools with insufficient material-technical bases will objectively remain outside MEDA monitoring. As stated in the Concept of Development of Preschool, Secondary, Technical, and Vocational Education of the Republic of Kazakhstan for 2023 – 2029, only 39% of rural schools have broadband Internet. Out of 6,909 public schools, 5,271 are in rural areas (GOV.KZ, 2023). Thus, approximately, at least as of 2023, about 68% of all schools in Kazakhstan will remain outside MEDA coverage (assuming no paper version is conducted, which would be very problematic both in terms of implementation and in terms of validity and reliability of the data obtained).

Also, it must be considered that MEDA, essentially a standardized test, can cause discomfort and stress among the testees. This can affect the reliability and objectivity of educational measurement. Moreover, the results of MEDA are used for comparative analysis of the quality of education in different schools, therefore there is a significant risk that schools will focus on "teaching to MEDA." This, in turn, will limit the educational process, focusing it on MEDA tests, without achieving the ultimate goals of education - acquiring modern competencies necessary for the successful integration of graduates into society and the economy.

It should be noted that MEDA, as a unified form of assessing educational achievements, does not always take into account the individual characteristics of the student, as well as the ethical, cultural, and local aspects of different regions of Kazakhstan. While MEDA, as a form of assessment necessary for the comparative analysis of educational organizations, may justify itself, it does not fulfil the functions for analysing in the context of monitoring the individual trajectory of a student, identifying their strengths and weaknesses, including personal qualities, identifying gaps and difficulties in their education, and diagnosing the presence or absence of skills.

The role of teacher assessment is also important here, aimed at providing the most effective educational support. As mentioned earlier, in assessing the modern competencies of a student, it is important to correlate it with the assessment of the teacher's work to ensure successful learning. However, the current state of teacher assessment does not fully meet such needs.

It must be noted that the main drawback of the current state of teacher assessment is the high risks of subjective evaluations, as the score of any given indicator of certification is predominantly determined by the internal conviction and subjective approach of the assessor. For example, the lesson evaluation sheet of the teacher being certified is filled out by the head of the secondary education organization, their deputy, another teacher, and a methodologist from the methodical office (center). Then, these evaluation sheets are assessed by members of a specially created commission. Therefore, different assessors from various schools and regions, at different levels, can have different opinions on what constitutes effective teaching.

Thus, the effectiveness of the certification largely depends on the qualifications and training of those who conduct the evaluation. Since such specialized training is not conducted, this can lead to ambiguous evaluations.

Often, the results of the certification are not used for real improvement of professional activity or the educational process but merely serve as a formality. Even if teachers receive feedback with suggestions for improving certain aspects of their activity, they do not always have the necessary support or resources for further professional development. It should also be said that a proper level of certification requires significant labour, time, and material costs. However, in conditions of high levels of three or more shifts or, conversely, small-complement schools, resources are extremely insufficient for conducting certification. Here it is important to understand that certification does not take into account differences in the conditions under which teachers work, material resources, the number and composition of students, and other external factors that affect the quality of teaching.

Discussion. These and other problems make the certification process not conducive to students acquiring 21st-century skills. A thorough analysis of many factors is required so that the evaluation system genuinely contributes to improving the quality of education and the professional growth of teachers.

Recent studies highlight the importance of integrating new technologies, particularly AI, into the processes of assessing teacher competencies. High-quality teaching using technical technologies depends on three basic components; pedagogical knowledge (teaching methods, classroom management skills, and assessment techniques of knowledge and skills), subject knowledge, technological knowledge (understanding the possibilities and challenges of applying technologies, as well as skills in using technologies), and those areas of knowledge and skills that intersect between these two components and all three components simultaneously (Celik, 2023). The current certification system and, in general, the entire evaluation system of teacher performance in the country does not take these components into account, let alone have an understanding of how to approach their evaluation, especially in evaluating skills at the intersection of these components

Psychological diagnostics and career guidance are not part of the external assessment of student competencies, but

they play an important auxiliary role in ensuring its objectivity, substantiation, and comprehensiveness. However, there are also problems in these areas today. Key among them is the lack of an integrated relationship between themselves, the results of academic learning, the pedagogical work of the teacher and its evaluation, with the process of forming test questions adaptive considering the psychology and career guidance of the student, the absence of a unified database with history and development dynamics, a systematic approach in the training of psychologists and career advisors. This is exacerbated by a sharp shortage of qualified specialists, the impossibility of covering all students with the services of psychologists and career advisors, the absence of modern methods of educational psychology and career guidance, methodological guidance, and quality control of the work of psychologists and career advisors.

Descriptive model of the System. To address the above tasks and problems, the creation of a System is proposed. It is expected that this system will contain the following parameters or interconnected modules:

Module "External assessment of the quality of education and monitoring of the individual educational trajectory from primary school to obtaining a specialty/qualification". The basis of external assessment should be testing, generated by AI, adaptive to the competence level and inclinations of each student. Such a personalized approach will promote comprehensive assessment and diagnostics of competence. The test adaptation algorithm will be regulated by AI based on the initial responses of the test subject, forming the difficulty level of subsequent questions. Thus, test takers showing a higher level of knowledge will receive more complex questions, while others with a lower level, will get simpler ones. Accordingly, they will receive different scores for these answers. Upon completion of adaptive testing, AI will analyze its results and form a personal report on the level of educational achievements of each student. These results will be used to form an individual plan for learning and self-education to fill gaps in knowledge, as well as to search for and provide didactic materials for further improvement in interaction with other System modules. Adaptive testing simplifies the assessment process, reduces testing time, and ensures more accurate and personal diagnostics and assessment.

To ensure comprehensive coverage of all individuals, considering the weak technical equipment of several educational organizations, it is possible to consider the option of conducting testing through a smartphone application with proctoring based on AI technologies. Considering that the questions for the test will also be generated by AI, this significantly reduces costs and expenses. This advantage provides opportunities for increasing the frequency, scale, and comprehensiveness of testing.

Module "Generation of test questions for students using AI technologies". As mentioned above, AI will generate new test assignments, taking into account their specification, the competence levels of the student, learning goals, trajectory, and history of learning, among other factors. The module will analyze educational materials, textbooks, articles, or other sources of information to identify key, current, and at the same time interesting topics, concepts, and facts for inclusion in the test questions for a specific student. Based on the analysis of these materials, as well as considering educational standards and curricula, the module will automatically generate various types of questions. The type of question will be determined by AI considering the skills to be assessed: reading and mathematical literacy, key profile knowledge, analytical skills, critical thinking, communication, and other modern skills. In generating questions, there should be interaction with other System modules containing information about academic results, psychodiagnostics, career guidance of the student, and the competence level of the teaching teacher. The goal of the module is to create test questions adapted to the individual needs and inclinations of each student, as well as aimed at studying his educational environment, including the class, school, the quality of teaching by the direct teacher, and other important factors.

With the help of AI, the module will automatically evaluate the quality of the created questions, taking into account their relevance, objectivity, validity, and reliability, as well as other criteria. The module will learn, update, and adapt based on feedback from students, teachers, administrators, and System experts, the results of testing and trials, as well as considering changes in curricula and educational standards.

Module "External Assessment of Teacher Competence Using AI and Database Technologies". This module is designed to assess the professional competencies of educators using AI technologies, integrated with other modules of the System. The module will also develop adaptive test items similar to those in the test generation module for students. As mentioned above, this will allow for a more accurate assessment of competencies.

This module will be integrated with educational portals, social networks, and other online resources where the teacher is professionally involved. It will analyze the results of adaptive testing, as well as the teacher's activities on educational portals, social networks, and other online resources. Additionally, functionality will be established for evaluating the teacher's instruction through AI-powered video monitoring of lessons. This will allow for a comprehensive approach to assessing a teacher's competencies, covering teaching methods, pedagogical practice, subject mastery, and other aspects of professional activity.

This module will compare the results of the teacher's assessment with the educational achievements of students, including comparing the teacher's responses to questions posed to both the teacher and the students ("anchor" questions). Based on the results of these analyses, the module will track and analyze the teacher's professional development, assessing their successes and the effectiveness of their chosen career trajectory. It will also provide feedback and individual recommendations for the teacher to enhance their professional competencies, develop self-improvement and additional training plans, suggestions for improving pedagogical practice, and select optimal future employment options based on an analysis of competence, personal characteristics, interests, and skills.

Additionally, the module can also provide recommendations to potential employers for choosing the most optimal candidates for specific positions or educational programs. For such selection, the module will rely on information regarding the educational organization, other teachers, and the student body.

This module will assist schools, colleges, and universities in selecting the most suitable candidates for teaching and administrative positions.

Module "Data Analysis and Recommendation Generation for Students, Teachers, School Administrators, and Education Authorities Using AI and Database Technologies". This module is a key component of the System and is intended for processing and analysing large volumes of data obtained from testing and studying other resources to generate recommendations. It will collect and process data obtained from testing, as well as open demographic, social, economic, and other information. AI algorithms will analyze vast arrays of data to identify patterns, trends, and key characteristics of a specific student's success and failure in education, and predict future educational success. Based on this, AI will create an individual learning and self-learning trajectory, adjusting the content and methods of education according to the individuality of each student.

Based on the results of the analysis, the module will generate recommendations for teachers, heads of educational organizations, and educational authorities to improve management activities and ensure the implementation of educational policy. The module will monitor the implementation of previously proposed recommendations and assess the effectiveness of their execution. For convenience, the module will include visualization functions, such as graphs, diagrams, and reports.

The module will also perform searches and present content tailored to the specific needs and interests of the user. Analysing data about a student's educational achievements, the module will recommend appropriate resources, adapt

educational materials, and organize educational games, and other activities to address knowledge gaps and errors.

Module "Psychodiagnostics of Students and Teachers Using AI and Database Technologies". This module will analyze the psychological parameters of students and teachers, assessing their emotional states, motivation, levels of stress and anxiety, adaptability, self-esteem, and other psychological aspects.

The module will develop adaptive psychological tests based on available information, including data from other modules of the System and social networks. This will allow for more accurate diagnostics of the psychological state of students or teachers, identifying areas where psychological support is needed. This includes determining the causes of depression, anxiety, behavioural disorders, etc. Additionally, the module will consider the individual characteristics of each participant in the educational process, automatically tracking changes in the psychological states of students or teachers. This will allow for the timely identification of potential problems and the implementation of preventive measures.

The module will also assess the ability to adapt to new learning or teaching conditions, providing feedback and support, if possible, in real time. For example, suggestions for stress management, recommendations for increasing motivation or improving psychological well-being, and achieving success. Based on the analysis results, the module will offer suitable tools for supporting mental health, including relaxation exercises, meditation, stress management, etc. This will help students and teachers quickly adapt and respond to changes in their psychological states.

This module will integrate with other modules of the system for data exchange and comprehensive analysis of the educational process to identify its strengths and weaknesses, the psychological compatibility of participants, and predict the success of learning and teaching considering the psychological characteristics of each participant.

This module plays an important role in creating a supportive environment for learning and teaching and enhancing the overall effectiveness of the educational process.

Module "Career Guidance for Students Using AI and Database Technologies". This module will analyze the interests, inclinations, and skills of students based on data from other modules of the system, including their academic achievements, preferences in selecting academic subjects, quality of task performance, interactive or extracurricular activities, and results of psychological diagnostics. The module includes conducting online testing and monitoring activity in open social networks.

This module will help students better understand themselves, their interests, and their needs, and analyze their professional interests and preferences, individual abilities, and inclinations toward certain types of activities. In this way, key personality traits, needs, and motivations of the student are identified.

The module will provide students with information about various professions, including future and promising ones, and the requirements for each profession. Based on this and information from other System modules, personalized recommendations are provided for choosing a professional path, educational direction, or career development, as well as the most suitable schools, colleges, and universities considering the student's characteristics.

As a result of the module's interaction with the students, their parents, social educators, and career counsellors, a step-by-step route for obtaining the chosen profession will be developed and monitored by the module. These module capabilities will enable students to make informed decisions regarding their future education and careers.

Conclusion. This System has no analogs in the world, although some individual solutions, as mentioned above, already exist in practice. The information and analytical content of the System's modules is interconnected, allowing for comprehensive analysis and relevant recommendations. The creation of this System will revolutionize education, significantly improve the quality of education, and provide more or less equal opportunities for obtaining quality education for various categories of

citizens and regions, including those in need. This will give better starting opportunities to many citizens of the country.

In summary, the following should be noted. The MEDA, as a unified system for monitoring educational achievements in secondary education, does not meet modern requirements for ensuring the goals of successful learning and the integration of students considering 21st-century trends and skills. The higher education system is not covered by such monitoring at all. The system for teacher certification, the activities of the psychological services in educational institutions, career counsellors, and social educators in schools are not mutually integrated and are not aimed at ensuring the common goal of successful learning and the acquisition of 21st-century skills by students. As shown above, today's technologies, without significant costs, make it possible to build a unified external assessment system incorporating individual learning trajectories. Given the need to assess 21st-century skills, a comprehensive assessment is necessary, and such an assessment is possible at the intersection of core subjects, psychological diagnostics, and career guidance. When developing an external assessment system using AI and Big Data, the most important aspect is the interconnection and integration of systems (modules) for testing, generating test tasks, psychological diagnostics, career guidance, and the analytical block.

The introduction of this system will eliminate corruption risks (in obtaining grades, job placement, grant distribution, rewards, etc.) through its transparency, objective external evaluation, and the impossibility of result correction. Through the System, it is possible to instil progressive values at the national level for the younger generation, promoting self-education skills, the development of critical thinking, and high intellectual preparation. This will, in general, contribute to the formation of an educated and progressive civil society.

The final decision in the system, when forming AI recommendations, should be adjusted by all involved teachers or heads of educational organizations or education management bodies. Given the scale of the System's application, this will allow the AI to improve at a faster pace.

The information-analytical system for external competency assessment can serve as an effective management tool in the education system. It will allow the heads of educational organizations and education management bodies to receive, analyze, and use data for making informed managerial decisions. Such a system, considering the interrelated work of various modules, will ensure effective monitoring and management of education quality. Based on the System's modules, it is possible to introduce the System's functionality in education management with minimal corruption risks and unjustified subjectivity (including in terms of selection and placement of managerial and teaching staff, reward and penalty systems), the functionality of optimal planning of educational programs, schedules, analysis of the current situation, forecasting success and risks, and the development of necessary managerial decisions. Thus, the development and implementation of the technologies described above open new prospects for transforming education into more effective, adaptive, accessible, and inclusive education.

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