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TRENDS AND PRACTICAL APPLICATIONS FOR ASSESSING THE QUALITY OF ELECTRONIC EDUCATIONAL RESOURCES

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Abstract

The article is devoted to the analysis of modern trends and practical aspects of assessing the quality of e-learning resources. It examined the multifaceted nature of the concept of "quality", its pedagogical, technical, and service dimensions. A comparative analysis of key assessment models such as Kirkpatrick, "E-Learning Success Model" and the UCL framework was conducted. Practical assessment methods such as questionnaires and LMS statistics were also discussed. An important part of the article is devoted to the impact of technologies such as artificial intelligence, in particular ChatGPT, on the assessment process, their capabilities, and the economic and ethical problems they cause. At the end, practical recommendations are given on quality assurance for educational institutions.

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I. Introduction

In the modern education system, e-learning occupies a central place, and its growth rates have reached unprecedented levels. This expansion has made it more urgent for educational institutions not only to introduce innovative technologies, but also to ensure and evaluate the quality of the education provided[1], [4]. Ensuring quality education has become not just an obligation, but a key factor determining the competitiveness of higher educational institutions in the context of globalization.

The concept of quality itself is abstract and multifaceted, which leads to the absence of a single, universally accepted method for its assessment. Recognizing this complexity, this article substantiates the need for a systematic review of various measures, models, and practical approaches to quality assessment.

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II. Quality of e-learning: conceptual framework and measurements

He showed that the concept of "quality" is not one-dimensional, but a complex construction consisting of many components. For effective quality assessment, it is first necessary to determine what it is and what measurements it consists of.

2.1. The versatility of the concept of quality

There are several approaches to the quality of e-learning, each of which focuses on different aspects of quality. Studies show that quality can be understood through five main categories: **exceptionalism** (striving for the highest standards), **excellence** (flawlessness and consistency), **expediency** (achieving the set learning objectives), **sufficient return** (repayment of investments) and **transformation** (significant growth in the student's competencies and abilities). From a pedagogical point of view, the "transformation" approach is the most important, since it reflects the achievement of the ultimate goal of education - the student's personal and professional development[4][10].

When assessing quality, it is important to clearly determine which approach is being used. For example, assessment from the perspective of "purposefulness" requires checking how well the goals set in the course curriculum have been achieved, while the "transformation" approach focuses on new skills and changes in the student's worldview that they can apply in real life after the course. This, in turn, requires different assessment methods and criteria. Thus, the first step in assessing quality is to define "quality" itself precisely and contextually.

In addition, quality can be considered from three main points of view: **pedagogical, technological,** and **economic** [8]. These approaches complement each other and help create a complete picture of quality. The concept of quality is not static, but dynamic; it varies depending on the purpose of the assessment and the expectations of stakeholders (student, teacher, institution).

2.2. Main quality measurements: three-component analysis

For a holistic understanding of the quality of e-learning, it is advisable to analyze it by dividing it into three main, but interconnected factors: the quality of teaching, technical quality, and the quality of service [8].

1) Teaching and pedagogical quality (Teaching Quality) – this component is focused on the content, methodology, and effectiveness of the educational process, and the main criteria for its assessment can be defined as follows [8]:

- correct choice of educational model;
- effectiveness of training strategies (case studies, project work, simulations);
- compilation of educational materials in accordance with the educational goals;
- availability of self-assessment tests;
- active participation and support of tutors, teachers, and experts in the educational process.

2) Technical quality (Technical Quality) – this component includes the reliability, functionality, and convenience of the technological platform and resources that implement the educational process. Main criteria[8], [11]:

- quality of content (adequacy, correctness, completeness);
- technological and aesthetic level of multimedia materials;
- functionality and convenience of the virtual learning environment (LMS/VLE);
- availability of systems supporting group work;
- optimal ratio of quality and price.

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3) Service Quality – this component is aimed at a system of continuous support for students and teachers throughout the educational process. Its main criteria[4][5][6]:

- adequacy and uninterrupted operation of the platform and infrastructure;
- organizational structure and responsibility of course staff (administrators, technical personnel);
- assistance provided to users (technological problems, academic consultations);
- availability of a support system for tutors and teachers.

These three components are closely related to each other. For example, a course with high pedagogical quality may lose its effectiveness due to an unreliable or complex technical platform. Studies show that students are often dissatisfied precisely with the lack of administrative and technical support, which negatively affects their overall educational experience. Similarly, perfect technology, but without weak pedagogical design and adequate support services, cannot effectively assist student learning. Therefore, when assessing quality, it is not enough to focus only on the content or the teacher's activity. The entire system – pedagogy, technology, and support services - should be evaluated together, based on a holistic approach. This approach highlights the weaknesses of quality more clearly and creates a basis for systemic improvements.

2.3. Differences from the point of view of stakeholders

Quality criteria have different significance for different stakeholders, and their priorities differ. When designing an effective assessment system, it is important to clearly define from whose point of view the assessment is being conducted [8].

Table 1. *E-learning quality criteria for various stakeholders*

Stakeholder	Main quality criteria
Industry (e-learning platforms)	Compatibility, interoperability, standardization (e.g., SCORM), scalable services, result-orientation.
Government	Control over content and curricula, equal opportunities, protecting students as customers, increasing effectiveness.
Higher education	Scientific relevance and updating of materials, author's authority and recognition, accreditation.
School education	Customer satisfaction, integration into curricula, educational value, user-friendliness of resources.
Vocational training	Support for contextualization, product quality, pedagogical design tailored to the student's needs, high level of interactivity.
Students	Convenience, interactivity, teacher support, practical significance, timely feedback.

This table clearly shows that "quality" is not a universal concept. Technical standards that are important for the platform (e.g., SCORM) may be secondary to the student [13]. While the government focuses on control and equal opportunities, higher education institutions prioritize academic prestige and scientific relevance. An effective evaluation system should balance these different interests and take into account the opinions of all stakeholders. This means that a single approach to quality assurance is ineffective and requires an assessment strategy tailored to each context.

III. Modern models and frameworks for quality assessment

Analysis of the developed theoretical and practical models for quality measurement shows that it is important to consider the specific features, advantages, and disadvantages of each of them.

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3.1. Process-Oriented approaches

While traditional assessment methods often focus on final results, such as exam scores or course completion indicators, the modern trend requires a transition to evaluating the entire educational process. This approach covers all the stages that affect quality - from course design to its implementation, interaction, and support. If previously quality was assessed mainly based on the quality of courses and predetermined learning outcomes, now process-oriented approaches have become dominant. This approach seeks to answer the question "how is quality created" and, instead of simply measuring the result, helps to identify specific opportunities for continuous improvement.

3.2. Kirkpatrick's adapted four-level model

Although this model was initially developed to measure the effectiveness of corporate training, its structure has been successfully adapted for a multifaceted assessment of the quality of e-learning. The model transforms assessment from a one-time event into a multi-stage process, allowing for a deeper study of the impact of learning [12], [14].

Stage 1. Reaction – at this stage, students' direct attitude and satisfaction with the learning process are measured. To determine how satisfied students are with the course content, teaching methods, instructor, and technology platform, surveys are usually conducted at the end of the course.

Stage 2. Learning – this stage assesses the knowledge, skills, and habits acquired by students. For this purpose, pre-test and post-test, often conducted at the beginning and end of the course, are used. These tests allow for the quantitative measurement of specific changes that occurred as a result of the educational process.

Stage 3. Behavior is the most important and at the same time the most difficult stage to measure. It studies how the acquired knowledge and skills are applied in practice, that is, in the student's professional activity or in subsequent studies. Evaluation is usually carried out through observations, questionnaires, or interviews sometimes after the completion of the course.

Stage 4. Results – this stage assesses the final, long-term impact of learning. In the corporate environment, this can be measured by financial profit, while in the university context, it is assessed through indicators such as improvement in students' competencies, career growth, or academic achievements.

The Kirkpatrick model allows us to move from the simple question "did students like the course?" to the deeper question "how did this course affect their practical activities and future?" It serves as a powerful tool for assessing the "transformational" aspect of quality.

3.3. E-Learning Success Model

This model presents the success of e-learning as a holistic and multifaceted construct, assessed in three consecutive stages. It systematically combines the three-component approach considered above and adds the "result" dimension to it [8], [9].

1) System Design – at this stage, the foundation of the system is assessed, including: system quality (ease of use, stability), data/content quality (relevance, accuracy) and service quality (speed, support).

2) System Delivery – at this stage, it is studied how the system is actually used and what impression it leaves on users. This includes the level of system usage and overall user satisfaction.

3) System Outcome is the final stage that measures the net benefits of learning (e.g., improved learning, time savings, academic success) and its negative aspects (e.g., lack of communication, feeling isolated, excessive reliance on technology).

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3.4. Institutional frameworks and standards

Many leading universities have developed their own internal quality assurance frameworks for the practical application of theoretical models. A striking example of this is the University College London (UCL) quality framework [5]. This framework transforms quality assurance from just a one-time assessment to a continuous, systematic monitoring and improvement process. The UCL framework covers six major areas [5], [6]:

1) course materials;

2) interactive learning environment;

3) activity and development of teachers;

4) assessment;

5) support for students;

6) administrative and technical assistance.

For each area, specific **criteria**, corresponding **standards**, **methods** for achieving these standards, **evidence** of achievement, and **risks** that may lead to quality degradation are predetermined. Such a systematic approach allows for a transition from reactive (resolving the problem after it occurs) to proactive (preventing problems) quality management. At the technical level, standards such as SCORM (Sharable Content Object Reference Model) are aimed at ensuring the smooth operation and reuse of educational content on various platforms and are an important component of technical quality [7], [13].

Table 2. *Comparative analysis of basic quality assessment models*

Model name	Basic principle	Methodology	Strengths	Weaknesses
Kirkpatrick model	Measuring the multi-level impact of learning (from reaction to outcome)	Questionnaires, tests, observations, analysis of results	In-depth analysis, the ability to measure the transformational impact of education	Measuring Levels 3 and 4 (behavior, results) is complex and time-consuming
E-Learning Success Model	Evaluate success through the interdependence of the system, delivery, and results	Measuring system quality, utilization rate, and net benefits	A holistic approach considers technological and human factors together	Multi-component assembly of all measurements may require resources
UCL Frameworks	Integrated institutional monitoring and continuous improvement	Systematic review based on criteria, standards, and evidence	Provides a practical, proactive, clear action plan	Adapted to a specific institute, it is difficult to transfer directly to other institutions

IV. Practical applications and methods of assessment

This chapter connects theoretical models with practice and examines specific methods, tools, and strategies used to assess the quality of e-learning.

4.1. Feedback collection strategies: holistic approach

Effective assessment should not rely solely on the opinions of students. It requires a holistic approach covering the perspectives of all stakeholders - **students, teachers, administrators,** and **technical staff**. Conclusions based on the opinion of only one group are often unilateral and incomplete. Most

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importantly, assessment should be carefully planned before the start of the course and included in its design as an integral part.

1) Formative/Embedded evaluation. The main goal of this approach is to identify problems when they arise and make timely corrections. This allows for dynamic improvement of the learning process.

Assessment methods - encouraging students to reflect on their learning and how the course helps them at predetermined times (for example, at the end of each module). This can be done by opening special topics in online discussion forums or by discussing them in small groups in face-to-face sessions. Also from students during the course requesting online learning diaries is also an effective tool that provides deeper insights into their experiences.

2) Final assessment (Summative Evaluation). This assessment is aimed at summarizing overall results after the course completion and gathering feedback to improve future courses.

Assessment methods – the most common methods are questionnaires and the formation of reference groups. Especially in blended learning courses, short focus group discussions conducted during face-to-face sessions can provide rich information about students' experiences [1].

4.2. Questionnaires: effectiveness and common shortcomings

Although questionnaires are the most common tool for evaluating e-learning, in practice their quality is often unsatisfactory. Analysis of 152 questionnaires used in organizations in Europe showed that their average score was only 1.95 on a 5-point scale, which is a very low indicator. These surveys are often conducted for formality, and the data obtained from them are not fully analyzed or do not lead to practical changes.

An effective survey must meet the following criteria:

- well-thought-out design. Questions should include open and closed types, their number should be within acceptable limits, the language should be simple and correspond to the course terminology. Instead of a general question like “Were the online classes helpful?”, it is more effective to ask specific questions like “Were the online classes helpful in understanding specific topics of the course?”.
- the correct method of application. While online surveys provide anonymity and ease of analysis, paper-based surveys can guarantee a high level of return in face-to-face training.
- timely implementation. Sending the questionnaire not at the end of the course and when students are preparing for exams, but at important stages of the course, for example, with feedback on assignments, increases the enthusiasm for answering.
- clear responsibility. A specific person responsible for collecting, analyzing, and sharing the results with the team must be identified.

Studies show that there is a large gap between the existing questionnaires and the real needs of students. For example, students often complain about problems related to technical and administrative support. However, the analyzed questionnaires practically do not contain questions specifically on technical issues. However, the analyzed questionnaires practically do not contain questions specifically on technical issues. This means that assessment systems often overlook the most painful aspects of quality.

4.3. Use of technology tools: LMS/VLE statistics

Virtual learning environments (LMS/VLE) automatically collect valuable information about student performance, and this information can be used as part of the assessment.

- Analyzed data – statistics such as the last login date, the number of messages sent, the most visited content pages, and forums.

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Opportunities and limitations – these statistics show the student's level of participation, activity, and which resources they use more. They are also a very useful tool for identifying students in the "risk group" who are experiencing difficulties entering or participating in the system. However, it should be borne in mind that these figures do not provide direct information about the quality or student satisfaction. For example, a student writing a lot of messages on a forum doesn't mean they're making meaningful contributions to discussions. Therefore, VLE statistics should be used in conjunction with other qualitative assessment methods (e.g., questionnaires, reference groups).

V. Developing trends: artificial intelligence in the assessment of education

The newest and transformational trend is the study of the influence of artificial intelligence (AI) on the assessment of the quality of education. AI is not just another tool; it should be viewed as a force that fundamentally changes the essence and methods of assessment.

5.1. Bilateral impact of artificial intelligence

Artificial intelligence influences the education system in two main directions [1]. On the one hand, it creates a demand for new competencies. The widespread use of AI in business and industry requires future specialists to acquire new knowledge and skills, including the ability to work with AI. This, in turn, requires the adaptation of educational programs to these changes. On the other hand, AI provides unprecedented opportunities for improving the educational process. AI algorithms help make learning more personalized, flexible, and effective.

5.2. The role of ChatGPT va generative AI

The emergence of generative AI programs, such as ChatGPT, has shown that it is possible to automate creative and intellectual tasks (for example, coursework, thesis, essay writing) that previously could only be performed by highly qualified people. This is a serious challenge to traditional teaching and assessment methods. AI's assessment capabilities:

- efficiency – AI allows you to effectively assess complex skills and knowledge in real time.
- personalization – it is possible to individually monitor each student's progress and provide timely feedback adapted to them.
- automation - significant savings in teachers' time (for example, up to 80%) can be achieved by automating time-consuming tasks such as checking open-ended written assignments. This allows teachers to dedicate more time to working directly and in-depth with students.
- new problems – traditional assessment methods, such as essays or coursework assigned as homework, may lose their relevance. The issue of plagiarism and academic integrity takes on a new, more complex character, as it becomes difficult to separate the student's work from the text created by AI. This requires a review of the evaluation paradigm. Perhaps now it will be necessary to move from evaluating the final product (written text) to evaluating the process (the student's ability to work with AI, the ability to critically analyze information).

5.3. Economic and ethical aspects

The introduction of artificial intelligence into education creates a number of economic and ethical problems, which cannot be ignored. In particular, as economic issues, it is necessary to take into account the need to accurately calculate the costs of implementing AI technologies and the expected benefits from it. Currently, there is practically no deep economic analysis in this area. In many cases, the penetration of AI into education stems not from the real needs of educational institutions, but from the proposals of technology companies. This situation is described in economic terms as "the economy of supply is superior to the economy of demand".

Ethical issues:

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1) a decrease in confidence, that is, to what extent do students and teachers trust AI-based assessment systems? Students can psychologically resist the assessment of their knowledge by a "non-living" algorithm;

2) fairness and bias – any AI algorithm can assimilate biases (for example, gender, racial, or social) in the dataset to which it is trained and reproduce them in the process of evaluation. This leads to an unfair assessment.

3) loss of creativity – when evaluating by AI, there is a risk that students will avoid non-standard, creative solutions and learn to give standard, "correct" answers that the algorithm "understands". For example, an AI system that has the original solution might evaluate the work of a student who made an arithmetic error at the end as identical (i.e., "false") to the work of a student who couldn't find the solution at all. This leads to a decrease in students' desire to take risks and think creatively.

Solving problems related to AI requires not only a technological, but also a deep pedagogical, economic, and ethical approach. The teacher's role should now focus not on competing with AI, but on developing high-level skills that AI cannot perform – critical thinking, problem-solving, creativity, emotional intelligence, and teamwork skills.

VI. Conclusions and Recommendations

This analysis showed that the assessment of the quality of e-learning resources is a complex, multifaceted, and constantly developing area. The main trends include the expansion of the concept of quality from technical aspects to pedagogical and transformational aspects, the orientation of assessment from the final results to the entire process, and the transition to the use of holistic models that take into account the opinions of all stakeholders. The emergence of artificial intelligence is emerging as a force that fundamentally changes the paradigm of evaluation.

The following practical recommendations have been developed for the effective implementation of the quality assessment system for educational institutions:

1. Defining the quality framework - each educational institution must clearly define what "quality" is for itself, based on its strategic goals and context. It is possible to replicate existing models, such as the UCL Quality Framework, but it will be necessary to adapt it to its own conditions.

2. Creating a comprehensive assessment plan – assessment should not be a one-time event, but an integral part of the course design. It is important to develop an assessment plan before the start of the course and involve all interested parties in it.

3. Using mixed methods – one should not rely on just one method. A more complete and in-depth analysis can be achieved by combining quantitative (questionnaires, VLE statistics) and qualitative (reference groups, interviews, learning diaries) methods. It is also necessary to use both current (formative) and final (summative) assessment.

4. Teacher support and training. Providing regular training and methodological support to teachers on the use of modern online pedagogy, assessment methods, and new technologies is a key to improving quality.

5. Responsible approach to artificial intelligence. It is necessary to deeply study the potential advantages and risks of AI. It is advisable to create working groups consisting of teachers, students, administrators, and technical specialists to develop specific policies and guidelines on issues such as academic integrity, fairness in assessment, and the prevention of bias.

Future research should be aimed at studying the long-term impact of artificial intelligence on education, ways to preserve and stimulate creativity and critical thinking in the assessment process, as well as the specifics of assessing the quality of e-learning in various cultural and social contexts. Quality assurance is a dynamic process, in which technological innovations and pedagogical wisdom must be combined.

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