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- інтелектуальні системи управління та аналізу даних;
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The proceedings contain papers on the following topics:

- trends and achievements in the development and application of methods and practical tools of artificial intelligence;
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**A STUDY OF CONTEMPORARY APPROACHES
TO THE DEVELOPMENT OF INTERACTIVE SYSTEMS
FOR ASSESSING LEARNERS' KNOWLEDGE**

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This research paper is devoted to the study of information technologies for the development of interactive systems for assessing the knowledge of students studying engineering subjects.

The assessment system in engineering education is undergoing a profound transformation driven by the introduction of information technology. Traditional written examinations and summative assessments, which have dominated for decades, are increasingly recognized as insufficiently effective for measuring the complex competences required of a modern engineer — in particular, the ability to solve unstructured problems, practical skills in working with equipment and software, as well as critical and creative thinking.

The requirements of international accreditation agreements, such as the Washington Accord under the Washington Protocol, which is based on the principles of outcomes-based learning, are forcing lecturers to review not only the content of study programs but also the methods used to assess knowledge. In response to this challenge, the academic and pedagogical community and educational technology developers have proposed a range of modern assessment methods which go beyond the simple digitization of paper-based forms and involve a systematic overhaul based on the principles of immediate feedback, adaptability and integration with the virtual environment of professional practice.

The most widespread and, at the same time, fundamental level of information technology implementation in testing is the use of automated and semi-automated digital platforms. Learning management systems, in particular the open-source Moodle platform and its ecosystem of add-ons, have provided lecturers in engineering disciplines with tools for conducting large-scale, frequent and customizable assessments. For example, by integrating Microsoft Excel with the FastTest plug-in within the Moodle environment, it is possible to generate an infinite number of individual tasks with varying numerical data for courses in materials science or structural mechanics, ensuring automatic marking and instant feedback.

Empirical studies show that although the initial setup of such a system requires additional time on the part of the lecturer, the long-term gains in productivity and the increase in students' engagement with the material are significant — in some cases, average academic performance increases by up to forty per cent compared with a control group studying using traditional methods. For programming disciplines, tools such as Virtual Programming Lab, CodeRunner and ProFormA have become particularly important, as they form a complete automated assessment pipeline: from syntax checking and compilation to running unit tests and detecting plagiarism. This

automation frees the lecturer from the routine task of checking for common errors and allows them to focus on analyzing architectural solutions and coding style, whilst students receive feedback in near real time, which encourages the iterative improvement of their own projects.

Another important area is the shift from one-off final examinations to continuous formative assessment of knowledge, using methods for collecting and analyzing big data on learning behaviors. Modern information systems make it possible to record not only the correctness of answers, but also the time spent on each task, the path taken between sections, repeated access to learning materials and the frequency of participation in forum discussions. A notable example is the practice at Xiangtan University in China, where a unified database has been created covering three categories of information: the content of learning resources, lecturers' actions and student activity.

This dataset enables the creation of individual competence profiles and the prediction of risks of academic failure at an early stage. Monash University in Australia has introduced problem-based assessment tasks on the Moodle platform, where students solve realistic engineering case studies with parameters that change depending on their previous answers, whilst interactive workshops allow for collective discussion of alternative approaches.

This approach, known as low-stakes assessment, reduces psychological pressure and is aimed at identifying gaps in knowledge rather than serving a punitive monitoring function, which is fully in line with the modern paradigm of 'assessment for learning' rather than 'assessment of learning'.

Methods based on virtual and augmented reality technologies, as well as gamification, deserve particular attention, as they enable the recreation of real-world engineering conditions that are impossible, too costly or too dangerous to simulate in a traditional classroom setting.

A systematic review of several dozen experimental studies has shown that the use of virtual reality in testing practical skills results in an increase in average marks of fifteen to seventeen per cent compared with a control group that undertook only traditional laboratory work. The addition of gaming mechanics — leaderboards, virtual badges, ranking systems and competitive elements — boosts students' intrinsic motivation, particularly among the 'digital native' generation, for whom gamified interfaces are a familiar environment for interaction. Many Ukrainian and international universities are introducing self-assessment systems featuring elements of 'competing against a computer opponent', where each correctly completed module unlocks access to more challenging tasks, thereby fostering a lasting positive habit of regular independent study.

The highest level of technological maturity in modern testing is computerised adaptive testing (CAT) incorporating elements of artificial intelligence, which radically changes the very logic behind the construction of an examination paper. Unlike a traditional linear test, where all students receive the same set of questions, an adaptive system uses answers to previous questions in real time to select, from a large bank of questions, those that offer the optimal level of difficulty and discriminatory power for a specific candidate. This allows the required level of

measurement accuracy to be achieved much more quickly — often with half the number of questions compared to a test of fixed length.

At the University of Málaga, in the ‘Energy Technologies’ module for Master’s students in Industrial Engineering, the adaptive approach has been successfully applied to the differentiated assessment of skills related to the analysis of energy flows. With the advent of generative artificial intelligence, particularly large language models, new prospects have opened up for the automated analysis of open-ended answers, project reports and even students’ video presentations, where not only the content but also the linguistic and prosodic characteristics of speech are assessed. Contemporary researchers are proposing hybrid assessment architectures in which artificial intelligence takes on the routine task of checking large volumes of text, whilst the lecturer focuses on strategic judgements, ethical considerations and personalized mentoring.

At the same time, the debate on preventing academic dishonesty has intensified: the most promising approach is not seen as banning generative AI, but rather creating open-format exams where students are permitted to use any tools, and are assessed specifically on their ability to ask the system the right questions, critically evaluate the answers received, and combine them with their own engineering experience to make informed decisions.

Modern methodological tools for assessment in engineering education have evolved into a complex, multi-level system encompassing automated platforms for mass assessment, digital tools for monitoring individual learning pathways, immersive virtual laboratories incorporating gamification elements, and adaptive assessment systems utilizing artificial intelligence technologies. The common conceptual basis for these approaches is the shift from summative assessment of learning outcomes to formative, personalized and context-oriented assessment of students’ professional competences.

At the same time, as researchers at Imperial College London point out, the development of digital assessment technologies is accompanied by the emergence of new challenges relating to ensuring the technical reliability of information systems, protecting personal data, overcoming digital inequality among those involved in the educational process, and developing valid tools for assessing complex competences.

A particular challenge lies in the objective measurement of creative, communicative and managerial skills, which depend mostly on the context of professional activity and are characterized by limited scope for formalization.

Under these circumstances, the further development of digital assessment methods should not be focused on the unconditional increase in the technological complexity of educational solutions, but rather on the development of pedagogically sound approaches that ensure a balanced combination of the advantages of the digital educational environment with the professional role of the lecturer as a bearer of engineering culture, professional values and ethical standards for future professional practice.