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IMPROVING THE QUALITY OF EDUCATION IN HIGHER EDUCATION THROUGH ARTIFICIAL INTELLIGENCE TECHNOLOGIES

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Abstract: The rapid development of artificial intelligence has created new opportunities for improving the quality, accessibility, flexibility, and effectiveness of higher education. Artificial intelligence technologies can support personalized learning, automate routine academic processes, provide immediate feedback, identify students at academic risk, improve assessment practices, and facilitate data-driven decision-making. This article examines the pedagogical and organizational potential of artificial intelligence technologies in improving the quality of education in higher education institutions. The study employs analytical, comparative, descriptive, and system-based methods to examine contemporary approaches to artificial intelligence-assisted teaching and learning. Particular attention is paid to adaptive learning systems, intelligent tutoring systems, learning analytics, automated assessment, generative artificial intelligence, virtual assistants, and predictive analytics.

Keywords: artificial intelligence, higher education, educational quality, adaptive learning, learning analytics, intelligent tutoring system, automated assessment, personalized education, digital transformation, academic integrity.

The digital transformation of society has significantly changed the requirements imposed on higher education institutions. Universities are expected not only to transmit theoretical knowledge but also to prepare specialists who can work with digital technologies, analyse complex information, solve practical problems, communicate effectively, and adapt to rapidly changing professional environments. Traditional teaching approaches alone may not fully satisfy these requirements because contemporary students differ in their academic preparation, learning pace, motivation, digital competence, and professional interests.

Artificial intelligence is becoming one of the most influential technologies in the modernization of education. Artificial intelligence can be defined as a set of computational methods and systems capable of performing tasks that normally require human intelligence, including reasoning, prediction, language processing, pattern recognition, decision support, and problem-solving. In higher education, artificial intelligence technologies are used in teaching, assessment, academic advising, student support, research, institutional management, and quality assurance.

The integration of artificial intelligence into higher education is especially relevant because universities generate large amounts of educational data. These data include attendance records, assessment results, learning management system activity, student feedback, assignment submissions, course completion rates, and academic progression indicators. Artificial intelligence and learning analytics tools can process such information and transform it into useful recommendations for teachers, students, and administrators.

However, the adoption of artificial intelligence does not automatically improve educational quality. Poorly designed artificial intelligence systems may create new problems, including algorithmic bias, data privacy violations, excessive dependence on technology, inaccurate generated information, weakened academic integrity, and reduced human interaction. Therefore, artificial

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intelligence must be introduced through a pedagogically justified, ethically responsible, and institutionally coordinated approach.

The purpose of this article is to analyse the possibilities of artificial intelligence technologies for improving the quality of higher education and to develop a conceptual framework for their effective implementation.

The main objectives of the study are:

1. to identify the main types of artificial intelligence technologies used in higher education;
2. to examine their influence on teaching, learning, assessment, and institutional management;
3. to determine the pedagogical and organizational conditions required for effective implementation;
4. to analyse the risks associated with artificial intelligence-supported education;
5. to propose a framework for improving educational quality through artificial intelligence technologies.

Artificial intelligence in education has developed from early computer-assisted instruction to sophisticated systems capable of adaptive learning, automated assessment, natural language interaction, and predictive analysis. Luckin et al. argue that artificial intelligence can support teachers by identifying individual learning needs and providing students with appropriate educational resources. Their work emphasizes that artificial intelligence should strengthen human teaching rather than replace educators.

Holmes, Bialik, and Fadel explain that artificial intelligence can improve teaching and learning through personalization, intelligent tutoring, automated feedback, and educational data analysis. According to the authors, one of the most important advantages of artificial intelligence is its ability to process learner data continuously and provide differentiated support.

Zawacki-Richter et al. conducted a systematic review of artificial intelligence applications in higher education. Their findings showed that many studies focused on student profiling, prediction, assessment, adaptive systems, and intelligent tutoring. However, they also found that the pedagogical role of teachers was insufficiently represented in some artificial intelligence studies. This suggests that technological development must be accompanied by educational and methodological research.

Ouyang and Jiao identify three main paradigms of artificial intelligence in education. The first paradigm views artificial intelligence as a tool that directs the learner. The second considers artificial intelligence as a system that supports collaboration between students and technology. The third focuses on learner agency, in which students actively use artificial intelligence to manage and improve their learning. The third paradigm is especially important for higher education because it encourages students to become responsible and reflective users of technology.

Hwang et al. emphasize that artificial intelligence can support personalized learning, automatic evaluation, intelligent recommendations, and educational decision-making. Nevertheless, they note that future artificial intelligence research must address ethical, psychological, pedagogical, and social questions.

UNESCO highlights the importance of a human-centred approach to artificial intelligence in education. Artificial intelligence systems must respect human rights, promote inclusion, protect personal data, and ensure equal access to educational opportunities. UNESCO also stresses the need to develop artificial intelligence literacy among teachers and students.

The literature demonstrates that artificial intelligence offers considerable educational potential. Nevertheless, its effectiveness depends on the quality of institutional policy, the digital competence of teachers, the reliability of technological infrastructure, and the ethical use of student data.

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This study uses a qualitative, analytical, and conceptual research design. It is based on the synthesis of academic publications, international policy documents, and theoretical approaches concerning artificial intelligence in higher education.

The following research methods were applied:

- **descriptive analysis** to identify the major artificial intelligence technologies used in universities;
- **comparative analysis** to examine traditional and artificial intelligence-supported educational processes;
- **system analysis** to investigate the relationships among technology, pedagogy, assessment, management, and educational quality;
- **content analysis** to classify the benefits, risks, and implementation requirements of artificial intelligence;
- **conceptual modelling** to develop an artificial intelligence-based framework for improving educational quality.

The study does not present experimental statistics or claim the results of a specific institutional intervention. Instead, it develops evidence-informed recommendations that may be adapted to different higher education contexts.

Educational quality is a multidimensional concept. It cannot be measured only through examination scores or graduation rates. The quality of higher education includes:

- the relevance of curricula;
- the professional competence of teachers;
- students' knowledge and practical skills;
- the effectiveness of teaching methods;
- fairness and reliability of assessment;
- accessibility of learning resources;
- student engagement and satisfaction;
- graduate employability;
- academic integrity;
- institutional capacity for continuous improvement.

Artificial intelligence can influence each of these dimensions. For example, adaptive learning can address differences among students, automated feedback can improve the learning process, and predictive analytics can help institutions identify students who need academic support.

However, artificial intelligence should be viewed as a means of improving educational quality rather than as the final objective of digital transformation.

Traditional university teaching often follows a uniform model in which all students receive the same content, assignments, and learning schedule. This approach may not adequately consider differences in students' prior knowledge, learning speed, interests, or difficulties.

Artificial intelligence-powered adaptive learning systems can analyse student performance and modify educational content accordingly. These systems may recommend:

- additional explanations for difficult topics;
- advanced tasks for high-performing students;
- revision materials for students with knowledge gaps;
- alternative formats such as video, text, diagrams, or simulations;
- individualized learning sequences;
- practice exercises based on previous mistakes.

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For example, in a computer networks course, an adaptive platform can analyse whether a student has difficulty understanding routing protocols, network addressing, or cybersecurity concepts. It can then provide targeted exercises and additional instructional materials.

Personalized learning may increase student motivation because learners receive tasks that correspond to their current level of competence. It can also reduce the risk of students becoming discouraged by materials that are either too difficult or too easy.

Nevertheless, personalized learning should remain under teacher supervision. Artificial intelligence recommendations may be incomplete or incorrect because they are based on available data and programmed criteria. Teachers must interpret the recommendations and consider students' psychological, social, and academic circumstances.

Intelligent tutoring systems are artificial intelligence-based programs that provide individualized instruction, guidance, hints, and feedback. They attempt to reproduce some functions of a human tutor by analysing the learner's actions and adjusting support.

An intelligent tutoring system usually contains:

1. a domain model representing the subject knowledge;
2. a learner model containing information about student performance;
3. a pedagogical model determining how instruction should be delivered;
4. a user interface through which the student communicates with the system.

In higher education, intelligent tutoring systems can be used in mathematics, programming, foreign languages, engineering, medicine, physics, and other disciplines.

For students studying computer systems and networks, intelligent tutoring systems can assist with:

- programming syntax and debugging;
- network configuration exercises;
- identification of logical errors;
- simulation of technical problems;
- step-by-step explanations;
- recommendations for further practice.

These systems are particularly useful outside classroom hours because students can receive immediate assistance. However, intelligent tutoring systems should not reduce direct communication between students and teachers. Human instructors remain essential for explaining complex concepts, motivating learners, evaluating creative work, and considering contextual factors that artificial intelligence cannot fully understand.

Assessment is a central component of educational quality. It provides information about whether students have achieved the expected learning outcomes. Traditional assessment can require significant teacher time, especially in large groups.

Artificial intelligence can automate or support the evaluation of:

- multiple-choice tests;
- short-answer questions;
- programming assignments;
- mathematical exercises;
- language tasks;
- structured reports;
- student participation data.

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Automated assessment can provide immediate feedback. Instead of waiting several days for results, students can identify mistakes immediately and revise their work. This supports formative assessment, in which evaluation is used not only to assign grades but also to improve learning.

Artificial intelligence may also help teachers develop assessment tasks by generating question variants, classifying questions according to difficulty, and connecting tasks with specific learning outcomes.

However, automated grading has limitations. Artificial intelligence may not accurately evaluate creativity, critical thinking, ethical reasoning, original argumentation, or context-dependent answers. Therefore, high-stakes assessment should not rely exclusively on automated systems.

A balanced assessment model may include:

- automatic evaluation of routine tasks;
- teacher evaluation of complex assignments;
- peer assessment;
- student self-assessment;
- oral examination;
- practical project evaluation.

Teachers must also verify whether artificial intelligence-generated questions are accurate, relevant, unbiased, and aligned with the curriculum.

Learning analytics refers to the collection, measurement, analysis, and interpretation of data about students and their learning environments. Artificial intelligence can identify patterns that may not be visible through traditional observation.

The following indicators can be analysed:

- attendance;
- frequency of access to learning platforms;
- time spent on educational resources;
- assignment submission patterns;
- assessment results;
- participation in online discussions;
- changes in academic performance;
- course completion behaviour.

Predictive models can identify students who may be at risk of academic failure or withdrawal. Early identification allows teachers and academic advisers to provide timely support.

For example, a student who rarely accesses the learning platform, repeatedly submits assignments late, and demonstrates declining test results may need academic, motivational, technical, or psychological assistance.

Nevertheless, predictive analytics should not label students permanently. Artificial intelligence predictions are probabilities rather than final conclusions. Incorrect classification may result in discrimination or reduced expectations. Therefore, institutions must ensure that teachers review predictive recommendations before making decisions.

Artificial intelligence technologies have significant potential to improve the quality of higher education. They can support personalized learning, intelligent tutoring, automated feedback, learning analytics, curriculum development, teacher professional growth, and institutional management. Artificial intelligence can help universities identify student needs more accurately, provide timely educational support, reduce routine workloads, and make decisions based on reliable data.

Nevertheless, the effectiveness of artificial intelligence depends on how it is designed and implemented. Technology alone cannot guarantee high-quality education. Artificial intelligence must

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be connected with clear learning outcomes, appropriate pedagogical methods, valid assessment criteria, teacher expertise, secure infrastructure, and ethical governance.

The most effective model is not one in which artificial intelligence replaces educators, but one in which teachers and artificial intelligence work together. Artificial intelligence can process data, identify patterns, generate initial materials, and provide routine feedback. Teachers must provide professional judgment, contextual understanding, ethical guidance, creativity, motivation, and human communication.

Therefore, universities should adopt a human-centred and quality-oriented approach to artificial intelligence. Sustainable implementation requires institutional policies, teacher training, student artificial intelligence literacy, transparent data practices, and continuous monitoring. When these conditions are satisfied, artificial intelligence can become an effective instrument for developing flexible, inclusive, innovative, and student-centred higher education.

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