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TECHNOLOGY FOR DEVELOPING INTELLECTUAL SYSTEMS FOR MONITORING STUDENTS' LEARNING ACTIVITIES IN THE EDUCATIONAL PROCESS

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Abstract: *The article scientifically substantiates the need to develop intellectual systems for monitoring students' learning activities in the context of the modern digital educational environment. The possibilities of improving the quality of education through the use of artificial intelligence, intelligent data analysis, neural networks, and adaptive learning technologies are revealed. Compared to traditional forms of monitoring, the advantages of intellectual systems, as well as their implementation mechanisms, performance indicators, and practical significance, are highlighted.*

The rapid development of globalization, the digital economy, and information and communication technologies requires fundamentally new approaches from the education system. The modern educational process is no longer limited to the mere transmission of knowledge; rather, it involves directing students toward independent inquiry, developing creative and critical thinking, forming problem-solving and decision-making skills. At the same time, the need to continuously analyze students' learning activities, monitor their developmental dynamics, and design individual learning trajectories is increasing.

Traditional systems of control and assessment are typically oriented toward final results and fail to fully reflect a student's activity throughout the entire learning process, the pace of mastering knowledge, difficulties encountered, or the level of cognitive load. The subjectivity of assessment, the strong influence of the human factor, and manual data processing generate serious challenges in managing educational quality. Consequently, the issue of automated, intellectual, and analytical monitoring of students' learning activities in the educational process is becoming particularly relevant.

The large volume of data accumulated in the digital educational environment—electronic gradebooks, assignment results, online tests, forum activities, attendance indicators—creates opportunities for the application of learning analytics and educational data mining methods. These approaches make it possible to identify hidden patterns in students' learning activities, predict their success or failure in advance, determine risk groups, and take preventive pedagogical measures.

Moreover, technologies such as artificial intelligence, neural networks, machine learning, and adaptive learning systems enable viewing assessment not merely as a control procedure, but as a learner-centered mechanism for managing education. With the help of intellectual monitoring systems, an individual learning strategy can be developed for each student, the complexity of learning materials can be adapted, gaps in knowledge can be identified, and recommendations for their elimination can be generated.

It should be particularly emphasized that the introduction of intellectual monitoring mechanisms in education has not only pedagogical but also organizational and managerial significance. Such systems improve the quality management system in educational institutions, expand the analytical information base for managerial decision-making, and ensure transparency and openness of the educational process. As a result, higher education institutions improve their rankings, competitiveness, and international reputation.

Therefore, the creation and development of intellectual systems for monitoring students' learning activities is an important research area from both theoretical-pedagogical and practical perspectives. This article provides a scientific analysis of the conceptual foundations of intellectual monitoring systems, their technological model, implementation mechanisms, and their impact on the quality of education.

Intellectual monitoring systems provide the following opportunities:

- analysis of the educational process in real time
- formation of an individual profile for each student
- automatic identification of knowledge gaps
- early identification of low-performing students
- prediction of learning outcomes
- generation of adaptive learning content

This allows modern education to rely less on the human factor and more on analytical information technologies.

The issues of educational monitoring are studied at the intersection of pedagogy, psychology, information technology, and management sciences. Numerous studies

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cover the following directions of educational quality assessment:

- test control systems
- rating-based assessment models
- competence-based assessment
- assessment mechanisms in e-learning systems
- learning analytics technologies
- adaptive learning environments

In recent years, Learning Management Systems (LMS), distance education systems, and AI-based platforms have been widely implemented. Of particular scientific interest are intellectual systems capable of automatically analyzing students' activities and providing individualized recommendations.

However, many existing developments are limited to recording assessment results only. This article, in contrast, considers monitoring as a technology for development.

Research aim, object, and subject

The aim of the research is to develop scientific and methodological foundations for improving systems of intellectual monitoring of students' learning activities in the educational process.

The object of the research is the educational process in higher education institutions.

The subject of the research is the technology of intellectual monitoring of students' learning activities.

Conceptual model of the intellectual monitoring system

The proposed model consists of the following blocks:

- **Data collection block:** All types of students' activities—examinations, tests, forums, assignments, laboratory work, attendance indicators—are automatically accumulated in the database.
- **Intellectual analysis block:** Data are processed using data mining, machine learning, and neural network algorithms.
- **Diagnostic block:** Identifies students' strengths and weaknesses and forms risk groups.
- **Prediction block:** Forecasts future changes in academic performance indicators.
- **Decision-making block:** Analytical information is generated for teachers, dean's offices, and faculty councils.

Table of monitoring indicators

o.	Indicator	Description	Source of Evaluation	Importance
	Attendance	Class attendance rate	Electronic gradebook	Reflects responsibility
	Activity	Participation in Q&A and discussions	Observation, LMS logs	Indicates motivation

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	Indepen dent work	Quality of completed assignments	LMS	Applicatio n of knowledge in practice
	Test results	Performanc e in assessment tests	Online testing system	Level of knowledge
	Progress dynamics	Growth over time	Analytics module	Indicator of development
	Compete ncy indicator	Practical skills	Portfolio analysis	Readiness for the labor market

Technology for Implementing an Intelligent System

The technology of implementing an intelligent monitoring system is carried out in the following stages:

1. **Diagnostic stage**

• analysis of the existing assessment system

• identification of existing problems

2. **Design stage**

• development of the information system architecture

• formation of an indicator system

3. **Experimental stage**

• pilot testing of the system

• comparison and analysis of the obtained results

4. **Implementation stage**

• introduction into educational practice

• development of methodological support

As a result of implementing the intelligent monitoring system:

• subjectivity in assessment decreases

• transparency of the educational process increases

• students begin to analyze their own learning activities

• the analytical workload of teachers is reduced

• managerial decisions in the educational process are made more rapidly

In addition, the system makes it possible to identify low-performing students in advance, which strengthens preventive approaches in education.

CONCLUSION

The scientific and analytical results presented above demonstrate that intelligent systems for monitoring students' learning activities are among the key factors in managing the quality of education. Through intelligent systems, the educational process is fully digitalized, analyzed, and forecast. As a result, transparency, accuracy, and objectivity of assessment are ensured, and opportunities arise to design individual

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learning trajectories. This, in turn, supports students' personal and professional development, increases the efficiency of management in educational institutions, and accelerates the transition to a digital education system.

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