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THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE FORMATION OF THE INNOVATIVE EDUCATIONAL ENVIRONMENT IN THE USA

Alisher Serikbayev
IT Expert, USA

A B S T R A C T

The article analyzes the impact of artificial intelligence (AI) technologies on the formation of an innovative educational environment in the United States. The study examined modern adaptive learning platforms, virtual assistants, and educational analytics methods that are actively used in university and online educational programs. Based on the analysis of empirical data, key benefits of implementing AI technologies were identified and recommendations for further development of educational practices were formulated. The results obtained confirm the strategic importance of AI for transforming education and creating flexible, student-centered learning systems.

K E Y W O R D S

Artificial intelligence, innovative educational environment, virtual assistants, personalized learning, USA, online education.

Introduction

The future of the educational environment is closely linked to technological evolution, in particular, the development of computing power and the emergence of new intelligent systems. The introduction and active use of artificial intelligence (AI) in education opens up new prospects and at the same time creates new challenges for teaching and learning. This process has the potential for a fundamental transformation of the internal architecture and management structures of educational institutions. AI acts not only as a tool for optimizing existing processes, but also as a catalyst for revising traditional educational models.

In the United States, where innovation has traditionally served as an impetus for social and technological change, the use of artificial intelligence (AI) in the educational environment is becoming a significant factor in improving the quality and accessibility of education.

AI offers new opportunities for personalization of the learning process, allowing educational programs to be tailored to the individual needs of students. In one of the key studies in the field of applying artificial intelligence to personalize learning, « Intelligence Unleashed : An Argument for AI in Education » noted that this contributes to improving academic results and reducing educational inequality [1]. An analytical report by McKinsey & Company writes that the implementation of AI technologies in US educational institutions can optimize the workload of teachers, increase student engagement , and improve the overall efficiency of the system [2].

In addition, AI is a powerful tool for developing educational data analytics. It allows educational institutions to effectively track student progress, identify problem areas, and make informed decisions based on big data analysis. The introduction of intelligent assistants and chatbots expands access to

educational resources and support, which has become especially relevant in the context of the widespread use of distance and inclusive learning after the COVID-19 pandemic [3].

However, the integration of AI into the educational environment is associated with a number of challenges: ethical dilemmas, issues of personal data protection and the need for retraining of teaching staff, etc. Despite these difficulties, the potential of AI in transforming educational practices remains high, so a systematic analysis and development of effective methods for its implementation are required.

Research Methodology

Our study used a comprehensive approach combining qualitative and quantitative methods aimed at analyzing the impact of artificial intelligence (AI) on the formation of an innovative educational environment in the United States. The methodology is based on modern approaches to the study of technologies in education and includes four main stages.

1. Systematic literature review. In the first stage, a systematic review of scientific publications, analytical reports and technical documents related to the application of AI in education was conducted. Academic databases such as Scopus, Web of Science, IEEE Xplore, and Google Scholar. This method allowed us to define the theoretical basis of the study, identify key trends, and the main challenges associated with the implementation of AI technologies. The main goal of this stage of the study was to identify and systematize existing theoretical concepts, technologies, practical approaches, as well as key problems and challenges associated with the use of artificial intelligence in education. To ensure the completeness and systematicity of the literature review, the methodological recommendations proposed by Boell and Cecez-Kecmanovic [4] and Webster and Watson [5] were used.

2. Analysis of empirical cases. The second stage included an in-depth study of real examples of AI implementation in US educational institutions using the case study method. Projects of large universities and startups using machine learning technologies and adaptive learning systems were analyzed. This approach allowed us to identify the specifics of their use, evaluate the achieved results and determine the key success factors. The study included an analysis of a number of empirical cases demonstrating the practical application of artificial intelligence (AI) technologies in the educational environment:

1. Startup «Carnegie Learning» has developed an adaptive mathematics learning system that adapts to the individual needs of students, helping to improve academic performance [6].

2. «Georgia Institute of Technology» introduced virtual teacher «Jill Watson», based on natural language processing technologies, which made it possible to automate answers to students' questions and reduce the workload of teachers [7].

3. The Knewton platform uses AI to analyze student behavior and provide personalized recommendations, which improves learning efficiency [8].

4. The «EdX» platform created by «MIT» and «Harvard University» integrates AI algorithms to adapt learning materials and automate assessment, expanding access to personalized online learning [9].

The analysis of these cases showed a wide variety of technologies used and confirmed the significant contribution of AI to the optimization of educational processes, improving the quality of learning and expanding the possibilities of personalization.

3. Quantitative data analysis. The study included a quantitative analysis of data collected on the educational platforms «EdX» and «Coursera». The analysis focused on data on the progress of undergraduate and graduate students. The study covered a number of key indicators characterizing educational activity: time spent on mastering materials; frequency of passing test assignments; results of control activities; level of interaction with adaptive learning systems. The use of machine learning methods made it possible to identify significant patterns in student behavior.
4. Generalization and interpretation of results. At the final stage, based on the synthesis of data obtained during the literature review and empirical analysis, conclusions were formulated on the strategic benefits and potential risks of using AI in education. Particular attention was paid to ethical aspects, data protection issues and requirements for the technological infrastructure of educational institutions.

Results of the Study

Quantitative analysis of educational data collected on the platforms «EdX» and «Coursera» demonstrated significant improvement in academic results when using adaptive learning systems. In the work of scientists «Beyond MOOCs: Sustainable Online Learning in Institutions» indicated that the implementation of artificial intelligence (AI) algorithms led to a 12% increase in students' average grades, as well as a 15% reduction in the number of course dropouts [9]. Similar conclusions were made in the study «Effects of Cognitive Tutor Algebra I on student achievement: A meta – analysis», where it was shown that the application of the Carnegie Adaptive Mathematical Platform Learning has been shown to increase algebra performance by 10–15% compared to traditional methods [6].
Analysis of the virtual assistant project «Jill Watson» showed that automating answers to routine questions allowed teachers to focus on more complex tasks that required their expertise. Students, meanwhile, gained access to 24/7 support, which increased their engagement and satisfaction with the learning process.
Using the Knewton platform has demonstrated that personalized recommendations based on student behavioral data analysis lead to deeper learning and, as a result, improved academic performance.
In Table 1, we present quantitative metrics for the effectiveness of AI implementation across platforms, reflecting increased academic achievement and improved student retention.

Table 1 - Results of the implementation of AI technologies in educational platforms

Platform	**Average increase in academic performance**	**Reduction in the number of student dropouts**
Carnegie Learning	10-15%	-
EdX (AI algorithms)	12%	15%
Knewton	-	-

Table 2 lists the main technologies and their impact on the educational process in the USA.

Table 2 - Main technologies and their impact on the educational process in the USA

Technology	**Description**	**Impact on education**
Adaptive learning	Personalized learning plans	Improving student efficiency and motivation
Intelligent assistants	Chatbots and virtual assistants	24/7 support availability
Learning data analytics	Monitoring and analysis of educational progress	Identification of problems and timely intervention
Automation of assessment	Machine learning for checking assignments	Reducing evaluation time and increasing objectivity

Conclusions

The conducted analysis demonstrates the significant potential of artificial intelligence (AI) in the formation of an innovative educational environment in the United States. The results of the study indicate that the introduction of AI technologies contributes to the improvement of the efficiency of training, personalization of the educational process and optimization of the activities of teachers. Below are the main conclusions drawn from the analysis:

1. Improving academic performance and engagement . Using adaptive systems based on AI (e.g. «Carnegie Learning» and «EdX») leads to significant improvements in academic results and a reduction in the number of students dropping out. Personalization of learning allows you to take into account the individual needs of students, which contributes to the growth of their motivation and the quality of assimilation of the material.

2. Optimization of teachers' work. Implementation of virtual assistants, such as «Jill Watson» automates routine tasks and improves communication with students. This allows teachers to focus on more complex and creative aspects of teaching.

3. Development of educational analytics. Quantitative analysis of data on students' learning activities helps to identify problem areas, predict the risks of academic failure and develop effective support measures. This approach contributes to the creation of more flexible and adaptive educational programs.

Recommendations for the implementation of artificial intelligence in the educational environment

Based on the analysis conducted, the following recommendations were developed for educational institutions seeking to implement artificial intelligence in their activities:

1. Active implementation of adaptive learning platforms. It is advisable to expand the use of AI systems that can analyze individual student behavior and offer personalized learning paths. This will improve academic performance and optimize the process of mastering the material.

2. Implementation of virtual assistants. It is recommended to implement AI assistants and chatbots in the educational process. This will ensure automation of responses to typical student requests and improve the quality of communication, reducing the workload of administrative and teaching staff.

3. Developing digital literacy for teachers. To effectively use the potential of AI technologies, it is critical to organize training for teaching staff in new digital tools and methods for analyzing educational data.

4. Applying educational analytics for support. Regular collection and analysis of data on students' learning activities should become the basis for timely identification of students in need of additional support, as well as for adapting educational programs in accordance with current needs.

Thus, the introduction of artificial intelligence into the US educational environment significantly improves the quality and effectiveness of education through personalization of educational materials, adaptive platforms, and automation of student support. Analysis of empirical data and cases shows a significant improvement in student performance and engagement, as well as optimization of teachers' work. The proposed recommendations contribute to the further development of innovative technologies in education, ensuring the flexibility and sustainability of educational systems in the context of digital transformation.

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