

PEDAGOGICAL FOUNDATIONS OF THE USE OF MULTI-AGENT SYSTEMS IN MODERN EDUCATION

Tursinbekova Inabat Joldasbekovna

Assistant teacher at

Karakalpak State University named after Berdak

<https://doi.org/10.5281/zenodo.17893341>



ARTICLE INFO

Received: 08th December 2025

Accepted: 09th December 2025

Online: 11th December 2025

KEYWORDS

Educational programs, pedagogical methods, teaching technology, multi-agent systems, pedagogical research, modern education

ABSTRACT

This study discusses the pedagogical foundations of the use of multi-agent systems in modern educational programs. The main importance of multi-agent systems in the educational program and the advantages of innovative opportunities based on the pedagogical environment of education are shown. Also, the use of multi-agent systems in the educational program mainly shapes the interaction between students and teachers. Also, during our study, the advantages and pedagogical principles of pedagogical approaches based on multi-agent systems in modern educational programs are discussed.

INTRODUCTION

Based on pedagogical analyses of the modern education system, new innovative pedagogical research has recently been conducted based on the use of digital technologies in pedagogical teaching methods based on the modern education system. New innovative approaches are being introduced to effectively organize the process of using methods based on pedagogical educational technologies based on educational programs. We will discuss the most relevant results of modern pedagogy in improving the quality of individual education of students through pedagogical methods based on educational technology in educational processes. Educational systems based on multi-agent software based on educational programs cover a number of independent studies. Multi-agent software based on modern research in the field of education consists of interacting agents, which allows ensuring efficiency in the educational environment. This allows increasing the learning efficiency of students through data analysis and the use of educational programs. In the modern education system, along with stabilizing the technology of using teaching methods through the use of multi-agent systems, the use of pedagogical methods based on new innovative systems in education serves to effectively improve the processes. The use of various methods in the educational environment allows you to control the activities of students, create conditions for providing the teacher with analytical information. The teacher performs the tasks of assessing the knowledge acquired by students, determining the level of knowledge of students, and forming individual educational paths. In such pedagogical approaches, the use of the teacher's pedagogical activity and pedagogical skills is of great importance. The use of multi-agent technologies in the education system increases the effectiveness of the educational process by applying pedagogical methods at different stages of education[1].

Using such pedagogical methods, it will be possible to analyze the level of knowledge of students in real time. When using educational programs, the teacher must be able to plan the educational process more correctly and thoroughly. Also, when using multi-agent systems in education, we need to support students' independent learning activities. It is necessary to create a comfortable learning

environment for students and simplify the learning process. Therefore, it is necessary to create new opportunities in the educational system to study the pedagogical foundations of the use of multi-agent systems in modern educational technologies based on innovative ideas in educational programs. We believe that it has important scientific and practical significance in the process of introducing innovative technologies into educational programs. The research methodology provides information on developing the functions of multi-agent systems in education, studying their advantages for students, and analyzing the mechanisms of their use in educational processes[2].

The use of multi-agent systems in educational programs is to create an intellectual system that is aimed at performing a specific task in cooperation with each other using several methods. Each pedagogically based method has a separate educational function, and they mainly work together towards a common goal. Through multi-agent educational systems, students can make decisions independently. The main features of such educational systems are that they are used in the educational system on the basis of decentralized management, that is, all educational system-based activities are not controlled by a single node. This further weakens the flexibility of the modern educational system and does not increase the importance of continuous education. Today, we can see the increasing complexity of the learning processes of modern educational areas[3]. The introduction of multi-agent approaches in educational programs serves to increase the effectiveness of this education. In today's modern educational environment, methods for increasing students' knowledge, creating a preparatory stage for subjects, and exploring students' interest in subjects are interconnected. Therefore, the use of the same teaching models in educational processes is not equally effective for all students. Pedagogical methods based on multi-agent systems based on educational programs help to increase flexible educational directions, taking into account the individual characteristics of students. We believe that by using teaching methods based on the pedagogical skills of teachers in educational programs, they can improve their methods based on analytical data obtained from the multi-agent system. Multi-agent systems improve students' question-answering skills and the process of completing assignments on the subject, students correct their mistakes and record repeated shortcomings. The use of such pedagogical approaches in education allows us to automate the process of assessing students in education. We also have the opportunity to monitor the dynamics of the development of students in the education system. Another advantage of using multi-agent systems in educational programs is to reduce the workload of teachers. In educational processes, the teacher faces difficulties in the process of individual control of a large group of students at the same time. Methods based on multi-agent educational systems allow us to easily perform this task and give the teacher only general results. This ensures that the teacher devotes more time to creative ideas and methodological activities in the educational process. The use of pedagogically based multi-agent systems in modern educational programs creates opportunities for the simultaneous performance of many functions in modern educational conditions. This includes creating an effective learning environment for diagnosing the knowledge acquired by students during the lesson, providing interactive recommendations on teaching methods, and continuous monitoring of the learning process. Based on the analysis of learning outcomes, all of these learning systems help to improve the quality of education and serve to increase the effectiveness of education[4]. Consequently, the introduction of methods for using multi-agent systems in pedagogical methods based on modern educational programs is becoming an integral direction of modern pedagogy. In order to effectively use multi-agent systems in educational processes, we need to deeply study their pedagogical foundations. In any case, if there is a technological solution to teaching in education, if it is not based on pedagogical principles, it will not be able to give the expected result in the educational process. Therefore, when using programs based on multi-agent systems in education, it is necessary to study a number of fundamental pedagogical principles. One of the effective educational aspects of multi-agent systems is to ensure a flexible approach to the student. Students differ in their level of knowledge assessment and psychological characteristics. It is also important to create an effective communication environment

between the teacher, student and the education system in the educational process. Multi-agent systems in educational processes help students analyze their own activities. According to the results of the analysis conducted in such educational programs, they can create favorable conditions for students to see their mistakes in the lesson and try to eliminate them[5]. New opportunities are being created in educational systems to motivate students to study, increase their interest, base the educational process on interactive methods, and form a positive attitude towards learning by using new methods of organizing lesson processes in the form of a game. It will be possible to automatically develop educational methods based on a system of incentives that are suitable for each student in the learning process. The results of pedagogical analysis conducted on the basis of practical research show that in higher education institutions where multi-agent systems based on teaching methods are used in the educational system, we can observe a certain increase in student activity. According to the results of the study, we studied the effectiveness of the individual learning model in educational processes and the accuracy of assessment[6].

Based on the results of our research, we can say that students can communicate with pedagogical methods based on multi-agent systems outside the classroom. This increases the mental development of students, their adaptation to the lesson. This constantly supports the activity of students during the lesson. Such pedagogical approaches form independent learning skills in students, organize the learning process through interactive methods, receive interesting information during the lesson and are focused on the results of mastering knowledge. Another advantage of multi-agent systems for educational institutions is the ability to control organizational processes. Through these educational programs, they successfully implement the processes of increasing educational efficiency, organizing the educational process in a differentiated manner and focusing on the student's personality, increasing their worldview, and ensuring the accuracy of assessing the quality of education.

CONCLUSION

In conclusion, it can be said that one of the innovative pedagogical approaches based on multi-agent systems in modern educational processes is the use of methods in various areas of the education system. The analysis conducted in our research shows that one of the main advantages of multi-agent systems in educational programs is the provision of person-centered education. This creates new opportunities in the education system for improving the level of knowledge of students and analyzing the dynamics of the development of their worldview.

REFERENCES:

1. Viswanathan, Nethra, Sofia Meacham, and Festus Fatai Adedoyin. "Enhancement of online education system by using a multi-agent approach." *Computers and Education: Artificial Intelligence* 3 (2022): 100057.
2. Hamal, Oussama, El Faddouli, and Moulay Hachem Alaoui Harouni. "Design and Implementation of the Multi-Agent System in Education." *World Journal on Educational Technology: Current Issues* 13.4 (2021): 775-793.
3. Bennane, Abdellah. "Tutoring and multi-agent systems: modeling from experiences." *Informatics in Education-An International Journal* 9.2 (2010): 171-184.
4. Sun, Shanghua, Mike Joy, and Nathan Griffiths. "The use of learning objects and learning styles in a multi-agent education system." *Journal of Interactive Learning Research* 18.3 (2007): 381-398.

5. Vicari, Rosa M., and Lucia MM Giraffa. "The Use of Multi-Agent Systems to Build Intelligent Tutoring Systems." AIP Conference Proceedings. Vol. 627. No. 1. American Institute of Physics, 2002.
6. Tsatsou, Dorothea, Nicholas Vretos, and Petros Daras. "Adaptive game-based learning in multi-agent educational settings." Journal of Computers in Education 6.2 (2019): 215-239.

