

ANALYZING STUDENTS' LEARNING ACTIVITIES BASED ON LEARNING ANALYTICS AND ARTIFICIAL INTELLIGENCE**Behruz Quvvatov Ulugbek ugli**Asia International University,
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<https://doi.org/10.5281/zenodo.20328769>**Abstract**

This article explores the issues of analyzing students' learning activities using Learning Analytics and artificial intelligence technologies. It examines the possibilities of determining students' knowledge levels, engagement, and academic performance indicators through the collection, processing, and analysis of large-scale data within the educational process. Furthermore, the significance of AI-based systems in organizing personalized education is highlighted.

Keywords: Learning Analytics, artificial intelligence, educational technologies, data analytics, adaptive learning, student activity, digital education.

Introduction

The rapid development of information and communication technologies and the widespread penetration of digital transformation processes into all sectors are bringing about fundamental changes in the education system. The modern educational environment is no longer limited to traditional classroom sessions but is organized on the basis of e-learning platforms, distance learning systems, mobile applications, and cloud technologies. As a result, large volumes of digital data related to students' learning activities are being generated — including assignment completion indicators, activity levels on platforms, test results, participation in forums and virtual discussions, and statistics on the use of educational resources. By systematically collecting and analyzing this data, the possibilities for improving the efficiency of the educational process, determining students' levels of achievement, monitoring their learning activities, and organizing education based on individual approaches are expanding. In recent years, Learning Analytics and artificial intelligence technologies have become an integral part of the digital educational environment. Learning Analytics serves to draw important conclusions about student activities through the collection, processing, analysis, and interpretation of data generated in the educational process. Through this technology, it becomes possible to detect problems in student achievement at an early stage, identify students in academic risk groups, evaluate the quality of education, and optimize the learning process. Artificial intelligence, in turn, enables forecasting, development of automatic recommendations, and creation of adaptive management mechanisms based on data obtained through Learning Analytics. In particular, artificial intelligence algorithms recommend individual learning materials based on a student's knowledge level, interests, and learning needs, as well as serve to form a personalized learning environment.

Furthermore, intelligent educational systems based on artificial intelligence are creating opportunities to support teachers' pedagogical activities, automate assessment processes, and make data-driven decisions. In this regard, the integration of Learning Analytics and artificial intelligence technologies is emerging as one of the important factors in developing the modern education system, improving the efficiency of the learning process, and supporting students' independent learning activities.

The Concept and Essence of Learning Analytics

Learning Analytics is a modern technological and pedagogical approach aimed at collecting, measuring, processing, analyzing, and interpreting data generated in the educational process. The main purpose of this technology is to improve the quality of education, effectively manage the learning process, deeply analyze students' learning activities, and make data-driven pedagogical decisions. Learning Analytics serves to improve the efficiency of the teaching process through the scientific analysis of large volumes of data generated in the education system. Through Learning Analytics technology, students' levels of achievement, pace of knowledge acquisition, learning activity, and independent learning activities are monitored. This system enables early detection of problems in student performance, which creates opportunities for teachers to provide timely pedagogical support and develop necessary methodological measures. Additionally, Learning Analytics serves as an important tool in forming individual learning trajectories. Based on a student's knowledge level, interests, needs, and achievement indicators, appropriate learning resources and assignments are recommended.

One of the important functions of this technology is the optimization of the educational process. Based on analysis results, teaching methodology is improved, the effectiveness of learning materials is evaluated, and weaknesses in the educational process are identified. At the same time, the ability to predict students' academic results in advance is created through the use of statistical and forecasting algorithms. This serves to identify students in academic risk groups and to address their learning difficulties.

The main data sources for Learning Analytics are formed on electronic and digital learning platforms. In particular, indicators such as students' login times, time spent on the platform, assignment completion status, test results, activity in forums and virtual discussions, and statistics on the use of electronic resources are analyzed. Based on this data, a model of the student's learning activity is formed, and precise conclusions about their level of achievement are drawn. Learning Analytics is emerging as one of the important tools for monitoring students' learning activities, improving the quality of education, ensuring individual approaches, and implementing effective pedagogical management in the modern digital educational environment.

The Role of Artificial Intelligence in Education

Artificial intelligence technologies, as an innovative component of the modern education system, are expanding the possibilities of automating, optimizing, and personalizing the learning process. These technologies enable the rapid processing of large volumes of data in the educational process, automatic analysis, forecasting, and development of recommendations. Artificial intelligence algorithms develop teaching strategies based on individual approaches through the analysis of students' learning activities, knowledge levels, interests, and achievement indicators. As a result, the efficiency of the educational process increases, a flexible learning environment suited to students' needs is formed, and the teaching process becomes more interactive.

Currently, artificial intelligence technologies are widely applied in various areas of education. In particular, adaptive learning systems are considered one of the most important directions of artificial intelligence. Such systems identify a student's knowledge level, pace of learning, and individual needs, and recommend appropriate learning materials and assignments. As a result, each student has the opportunity to acquire knowledge in accordance with their capabilities and level of preparation. Adaptive learning systems serve to improve the quality of education through the individualization of the learning process.

Intelligent tutoring systems based on artificial intelligence perform the function of a virtual teacher. These systems conduct interactive communication with students, explain complex topics, answer questions, and develop recommendations. Intelligent tutors are also of significant importance in supporting students' independent learning activities. Especially in distance

learning conditions, such systems create the opportunity to provide continuous methodological assistance to students.

Another important direction of artificial intelligence in education is automated assessment systems. These systems save teachers' time by automatically checking tests, written assignments, and practical tasks, while also increasing the objectivity of the assessment process. Through artificial intelligence, errors in students' responses, gaps in knowledge, and levels of achievement are quickly identified. This provides important assistance to teachers in organizing individual pedagogical approaches. Additionally, forecasting systems are considered one of the promising directions of artificial intelligence technologies in education. Such systems predict a student's academic success in advance based on statistical and machine learning algorithms. As a result, the opportunity to identify students experiencing difficulties or belonging to academic risk groups at an early stage is created. This serves to develop preventive measures and improve educational effectiveness. Furthermore, chatbots and virtual assistants are also widely used in the educational process. They provide quick answers to students' questions, offer guiding recommendations on learning materials, and simplify information exchange in the educational process. Since virtual assistants operate on a 24/7 basis, students have the opportunity to access necessary information at any time.

Overall, the integration of artificial intelligence technologies into the education system is emerging as an important factor in improving the efficiency of the learning process, forming individual learning environments, optimizing teacher activities, and elevating the quality of education to a new level.

Analyzing students' learning activities based on Learning Analytics and artificial intelligence is a complex, multi-stage, and data-driven process. This process encompasses the collection, processing, and analysis of large volumes of data generated in the educational environment, as well as making effective pedagogical decisions based on them. Modern e-learning platforms and digital technologies are creating opportunities to automate this process and conduct monitoring in real time.

The first stage is the data collection process. At this stage, various indicators of student activity are generated and stored through e-learning platforms. In particular, digital learning systems such as Moodle, Google Classroom, Canvas, and Microsoft Teams collect data on students' login times, platform activity, assignment completion status, test results, forum participation, and indicators of electronic resource usage. This data serves as the primary information source for Learning Analytics.

In the second stage, the collected data is processed. During this process, data is organized, filtered, unnecessary or duplicate data is removed, and it is prepared for analysis. The data processing stage is of crucial importance in ensuring the accuracy and reliability of analysis results. At the same time, data standardization and integration processes are also carried out.

The third stage is the analysis stage, in which statistical methods, data analytics, and machine learning algorithms are utilized. Through these technologies, students' learning activity, knowledge levels, achievement indicators, attendance status, and independent learning activities are analyzed. Through artificial intelligence algorithms, trends in student activities are identified, academic success is predicted, and problems in the learning process are detected at early stages. This provides teachers with the opportunity to implement individual pedagogical approaches.

In the fourth stage, analysis results are visualized. Through graphs, diagrams, dashboards, and interactive reports, the obtained data is presented to teachers, administrators, and educational institution management. Analytical data in visual form serves as an important tool for quickly assessing the state of the learning process, identifying problems, and making strategic decisions.

The fifth stage encompasses the decision-making process. Based on analysis results, individual assignments are developed for students, additional sessions are organized, teaching methodology is improved, and teaching strategy is optimized. In this way, Learning Analytics and artificial intelligence technologies form a data-driven management mechanism.

The advantages of Learning Analytics and artificial intelligence technologies in education are extensive. First and foremost, these technologies serve to improve the quality of education. Through deep analysis of student activities, shortcomings in the teaching process are identified and opportunities to address them are created. Additionally, an adaptive learning environment organized on the basis of an individual approach presents learning materials appropriate to each student's knowledge level and needs. Moreover, Learning Analytics technologies enable real-time monitoring of student activities. As a result, problems in the learning process and students in academic risk groups are identified early. This helps in implementing preventive pedagogical measures in a timely manner. Automated systems based on artificial intelligence reduce teachers' workload, simplify assessment and monitoring processes, and expand the possibilities for making effective decisions. Furthermore, adaptive learning systems formed on the basis of artificial intelligence provide an individual approach for each student. Such systems recommend appropriate learning content based on the student's level of achievement, interests, and learning needs. As a result, the efficiency of the educational process increases, student motivation strengthens, and independent learning activities develop. Overall, the integration of Learning Analytics and artificial intelligence technologies is emerging as one of the important factors in developing the modern education system.

Problems and Limitations

Although the widespread implementation of Learning Analytics and artificial intelligence technologies in the education system is of significant importance in improving educational effectiveness, certain problems and limitations associated with this process also exist. Since these technologies are based on the collection and processing of large volumes of data, one of the most pressing issues is ensuring the security of personal data. The storage of academic results, personal information, platform activity indicators, and other digital information about students in an unprotected state may create the risk of data leakage or unauthorized use. Therefore, the use of modern data protection technologies in educational institutions is of critical importance.

Furthermore, data confidentiality is also one of the significant issues. Learning Analytics systems collect large volumes of individual data through continuous monitoring of student activities. In some cases, this may raise issues related to personal privacy and ethical standards. When using data about students, it is essential to strictly adhere to the principles of ensuring transparency, obtaining user consent, and using data exclusively for educational purposes.

The insufficient development of technical infrastructure in implementing Learning Analytics and artificial intelligence technologies is also one of the notable problems. In some educational institutions, the lack of modern servers, high-speed internet networks, cloud technologies, and necessary software tools for data processing hinders the effective functioning of these systems. Particularly in developing countries, the limitation of technical and financial resources is one of the factors slowing this process.

Additionally, the shortage of qualified specialists capable of working with these technologies is also one of the pressing issues. Effectively managing Learning Analytics and artificial intelligence systems requires specialists with sufficient knowledge and skills in pedagogy, programming, data analysis, and artificial intelligence. However, in practice, the number of personnel with such integrated competencies is observed to be insufficient. Therefore, developing the digital competencies of teachers and specialists, retraining, and upgrading their qualifications is an important task.

Moreover, the possibility of errors in artificial intelligence algorithms also exists. Machine learning models may draw incorrect conclusions when operating on inaccurate or insufficient data. This creates the possibility of subjectivity or unfairness in evaluating student activities. In some cases, algorithms may also replicate existing stereotypes and erroneous trends in data. Therefore, continuous monitoring of the accuracy and objectivity of artificial intelligence systems is of significant importance.

For this reason, when implementing Learning Analytics and artificial intelligence technologies in the education system, special attention must be paid to information security, data confidentiality, ethical principles, and technological transparency. To effectively apply these technologies, it is important to improve the regulatory and legal framework, develop modern technical infrastructure, and strengthen the specialist training system. Only then will it be possible to effectively use Learning Analytics and artificial intelligence technologies to improve the quality of education and optimize the learning process.

Conclusion

In conclusion, Learning Analytics and artificial intelligence technologies are emerging as one of the important tools for modernizing the contemporary education system, digitalization, and improving management efficiency. By analyzing the large volumes of data generated in the digital educational environment, the opportunity to deeply study students' learning activities and accurately assess their knowledge levels, engagement, motivation, and achievement indicators is created. This serves to organize the educational process on a scientific basis and make effective data-driven pedagogical decisions. Through Learning Analytics technologies, the possibilities for real-time monitoring of student activities, early identification of students in academic risk groups, and providing individual pedagogical support are expanding. Artificial intelligence, in turn, serves to create a personalized learning environment by forming adaptive management mechanisms based on this data. As a result, the opportunity to present learning content and assignments appropriate to each student's knowledge level, interests, and learning needs emerges. This is of significant importance in improving the efficiency of the learning process, strengthening student motivation, and developing independent learning activities. Additionally, automated systems based on artificial intelligence expand the possibilities for reducing teachers' workload, simplifying assessment and monitoring processes, and controlling the quality of education. Through the use of statistical analysis, machine learning, and forecasting algorithms, it becomes possible to predict students' academic results in advance and identify problems in the learning process early.

In the future, the further development of adaptive and intelligent learning systems based on artificial intelligence will serve to improve the efficiency of the educational process, fully digitalize learning activities, and widely implement the concept of individual education. At the same time, for the effective use of Learning Analytics and artificial intelligence technologies, special attention must be paid to information security, data confidentiality, ethical standards, and the development of technical infrastructure. Overall, these technologies are emerging as an important factor in the innovative development of the education system and are of significant importance in forming the digital model of future education.

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