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LEARNING ANALYTICS-DRIVEN IDENTIFICATION OF STUDENT ENGAGEMENT PATTERNS AND ACADEMIC PROGRESS IN ONLINE EDUCATION

Akhmadaliyev Dilshodbek Muminjonivich
Sharda University Uzbekistan, Andijan, Uzbekistan
First-Year Master's Student, Department of computer science and engineering
E-mail: axmadaliyevdilshodbek058@gmail.com
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Abstract. This article explores the possibilities of determining students' learning activity and academic achievement in an online learning environment based on learning analytics. The study provides a comparative analysis of international scientific literature and regulatory documents on the digitalization of higher education in Uzbekistan. The frequency of students' access to e-learning platforms, the regularity of completing assignments, the use of educational resources, and the results of assessments are considered as the main analytical indicators. As a result, a conceptual approach is proposed aimed at comprehensively assessing student activity, early identification of academic difficulties, and supporting individual learning.

Keywords: learning analytics, online learning, student activity, academic achievement, digital learning, LMS, educational monitoring.

Аннотация. В данной статье рассматриваются возможности определения учебной активности и академической успеваемости студентов в онлайн-среде обучения на основе аналитики обучения. Исследование включает сравнительный анализ международной научной литературы и нормативных документов по цифровизации высшего образования в Узбекистане. В качестве основных аналитических показателей рассматриваются частота доступа студентов к платформам электронного обучения, регулярность выполнения заданий, использование образовательных ресурсов и результаты оценок. В результате предлагается концептуальный подход, направленный на комплексную оценку активности студентов, раннее выявление академических трудностей и поддержку индивидуального обучения.

Ключевые слова: аналитика обучения, онлайн-обучение, активность студентов, академическая успеваемость, цифровое обучение, LMS, мониторинг обучения.

Introduction. The development of digital technologies is significantly changing the methods of organizing the educational process and assessing student knowledge. The possibilities of collecting and analyzing data on student activity through Moodle, Google Classroom and other e-learning platforms are expanding. However, in order to effectively use this data, it is necessary to interpret it pedagogically correctly.

Siemens and Long define learning analytics as a tool for making data-based decisions in understanding and improving the educational process. Ferguson associates the development of learning analytics with the need to increase educational efficiency.

In Uzbekistan, the digitalization of higher education is also one of the priority tasks. In particular, the Decree of the President of the Republic of Uzbekistan No. PF-5847 pays special attention to the issues of introducing modern information technologies into higher education. At the same time, scientifically based analysis of data collected on digital learning platforms helps to more

accurately assess student engagement in the learning process. In particular, early identification of factors affecting academic performance is one of the important conditions for improving the quality of education.

The purpose of the study is to study the potential of learning analytics in determining student engagement and academic achievement in online learning and to develop scientific and practical recommendations for its effective use.

The study was based on the methods of scientific literature analysis, comparative study and conceptual modeling. The theoretical basis was the studies of Siemens and Long, Ferguson, Fredricks et al., Macfadyen and Dawson.

The following indicators were identified to assess student activity:

1. Platform activity — regularity of logins and use of educational resources.
2. Completion of educational tasks — the level of submission of tasks within the established deadlines.
3. Communicative activity — participation in forums, discussions and online classes.
4. Academic results — test, control work and final assessment indicators.

Based on these indicators, a comprehensive model for assessing student participation in the educational process was developed. The study did not use primary experimental data. The chosen methodological approach made it possible to compare results from various scientific sources and identify general patterns. In this regard, special attention was paid to assessing the relationship between educational activity indicators and academic results.

A comparative analysis of scientific literature showed the need to assess the relationship between student activity and academic results in online education based on several indicators.

Macfadyen and Dawson found that some performance metrics recorded in an LMS system can be used to predict academic performance. However, the number of logins to the platform does not fully reflect the level of student learning.

Table 1. Conceptual Model for Assessing Student Engagement Using Learning Analytics

Indicator	Data Analyzed	Pedagogical Significance
Platform activity	Frequency and regularity of logins	Monitoring participation trends
Assignment completion	Submission deadlines and completion status	Assessing learning discipline
Learning resources	Use of educational materials	Identifying learning habits
Academic performance	Quiz and assessment scores	Evaluating academic progress over time

Based on the analysis, it was determined that student activity can be conditionally divided into high, medium and low levels. In this case, the levels of activity should be based not on a single indicator, but on a set of participation in the educational process and academic results.

The proposed approach can serve as a methodological basis for timely identification of negative changes in student learning, planning additional pedagogical support and formulating individual educational recommendations. In addition, with the help of educational analytics, it becomes possible to systematically monitor changes in student activity throughout the semester. Such monitoring can help teachers identify problems in the educational process without waiting for the final assessment stage and determine appropriate pedagogical measures.

The theoretical results obtained show that educational analytics is not just a statistical monitoring tool, but an approach that supports pedagogical decisions. As Fredricks et al. noted, student activity consists of behavioral, emotional and cognitive components. Therefore, it is not correct to equate actions on digital platforms with the overall educational activity of a student.

The use of e-learning platforms in higher education institutions of Uzbekistan creates an important opportunity for the development of educational analytics. In particular, identifying interruptions in the performance of students' tasks, monitoring academic results, and providing teachers with timely analytical information are promising areas.

At the same time, when implementing educational analytics in practice, it is necessary to pay attention to the issues of protecting personal data, the objectivity of algorithmic conclusions, and the interpretation of digital indicators in a pedagogical context. Analytical systems should serve to substantiate the teacher's decision, without completely replacing it. It is also important to take into account their individual learning style, technological capabilities, and independent learning conditions when assessing student activity. This approach will serve to make the assessment process based on digital data fair and pedagogically sound.



Figure 1. Learning Analytics-Based Monitoring of Student Engagement and Academic Progress in Online Education.

The figure illustrates how learning analytics helps monitor student engagement and academic performance in online education. By analyzing login frequency, assignment completion, discussion participation, and assessment results, educators can identify learning patterns, detect academic risks early, and provide personalized support to improve student outcomes.

The study found that learning analytics has important methodological opportunities in assessing student engagement and academic achievement in online learning. The analysis of scientific sources showed that the combined study of platform engagement, task completion, and

academic results helps to gain a broader understanding of student engagement in the learning process.

The development of learning analytics in the higher education system of Uzbekistan can be useful in improving academic monitoring, early identification of learning difficulties, and organizing individual pedagogical support. In the future, it is advisable to empirically test the proposed model based on real LMS data and assess its accuracy and practical effectiveness. At the same time, it is necessary to develop the digital competencies of professors and teachers for the effective use of learning analytics in higher education institutions. Research in this area can further strengthen the scientific basis for individualizing the educational process and supporting students' academic success.

Conclusion. Learning analytics provides valuable opportunities to identify student engagement patterns and monitor academic progress in online education. By analyzing data such as attendance, login frequency, learning activities, assessment results, and interaction levels, educational institutions can gain deeper insights into students' learning behaviors. These insights help identify students who may be experiencing difficulties or showing signs of disengagement at an early stage. Furthermore, data-driven analysis enables educators to develop personalized learning strategies and provide timely academic support. The effective application of learning analytics can improve teaching methods, strengthen student participation, and enhance the overall quality of online learning. However, successful implementation requires reliable data, appropriate analytical tools, and careful consideration of student privacy. Ultimately, integrating learning analytics into online education contributes to more informed educational decisions and supports better academic outcomes.

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