

LMS TOOLS FOR IDENTIFYING AND ANALYZING MOTIVATIONAL INDICATORS OF HIGHER EDUCATION STUDENTS

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Annotation: The article explores the potential of Learning Management Systems (LMS) for identifying and analyzing motivational indicators of higher education students. It outlines the theoretical foundations of academic motivation, its structure, and behavioral manifestations in digital learning environments. The paper examines LMS tools such as activity logs, analytics dashboards, tracking systems, embedded surveys, and adaptive learning mechanisms that provide quantitative and qualitative data on students' intrinsic and extrinsic motivation. The significance of educational analytics and machine learning algorithms for interpreting motivational indicators, predicting risks of motivational decline, and enabling timely pedagogical intervention is emphasized. Methodological principles for using LMS as a management instrument to create personalized learning pathways are proposed.

Keywords: LMS, student motivation, learning analytics, digital education, motivational indicators, higher education.

Анотація: Стаття присвячена дослідженню можливостей систем управління навчанням (Learning Management Systems, LMS) щодо виявлення та аналізу мотиваційних показників здобувачів вищої освіти. Розкрито теоретичні засади академічної мотивації, її структурні компоненти та поведінкові прояви в цифровому освітньому середовищі.

Проаналізовано інструменти LMS (лог-файли, аналітичні панелі, системи відстеження активності, вбудовані опитувальники та механізми адаптивного навчання), які дають змогу отримувати кількісні та якісні дані щодо внутрішньої та зовнішньої мотивації студентів. Обґрунтовано значення освітньої аналітики та алгоритмів машинного навчання для інтерпретації мотиваційних індикаторів, прогнозування ризиків зниження мотивації та своєчасного педагогічного втручання. Запропоновано методичні засади використання LMS як інструментарію освітнього менеджменту, спрямованого на формування персоналізованих траєкторій навчання.

Ключові слова: LMS, мотивація студентів, освітня аналітика, цифрове навчання, мотиваційні індикатори, вища освіта.

The rapid digitalization of higher education has significantly transformed the nature of student–teacher interaction, learning processes, and approaches to educational management. Learning Management Systems (LMS) now perform not only administrative and content-delivery functions but also serve as powerful analytical tools capable of diagnosing cognitive, behavioral, and motivational aspects of learning. In contemporary educational research, motivation is recognized as a key predictor of academic success, persistence, and engagement. While traditional approaches rely primarily on surveys and qualitative assessments, LMS-based analytics provide real-time, data-driven insights into students' motivational dynamics.

The study of motivational indicators within LMS environments is becoming increasingly relevant due to the shift toward blended and fully online learning models. These models require students to demonstrate high levels of self-regulation, autonomy, and sustained engagement, making the timely identification of motivational risks essential for ensuring quality learning outcomes. Despite growing interest in educational analytics, the use of LMS as a tool for diagnosing motivation remains insufficiently explored [1].

The purpose of this study is to analyze the capabilities of Learning Management Systems in identifying, monitoring, and interpreting motivational indicators of higher education students, and to determine how LMS tools can support evidence-based pedagogical decision-making aimed at sustaining student engagement.

To achieve the stated purpose, the following research objectives have been established:

1. To examine theoretical approaches to academic motivation and determine which motivational constructs can be observed through LMS-generated data.
2. To analyze key LMS tools and features that allow the detection and interpretation of motivational indicators.
3. To explore the role of educational analytics and machine learning in predicting motivational decline and supporting timely intervention.
4. To propose methodological recommendations for using LMS tools to enhance motivation and personalize learning pathways.

In contemporary digital learning environments, the study of academic motivation acquires particular significance, as the transition toward blended and fully online modalities reshapes the conditions under which students engage with educational tasks. Digital formats require a higher degree of autonomy, self-regulation, and sustained interest, while also reducing the immediacy of instructor-mediated guidance. Traditional theoretical perspectives—most notably self-determination theory (Ryan & Deci), expectancy–value theory (Eccles), and Bandura’s social-cognitive theory—remain foundational, yet in online contexts they are complemented by a new empirical layer: the behavioral traces that students leave within Learning Management Systems (LMS) [2]. Motivation, which once had to be inferred primarily from verbal reports or face-to-face behaviors, can now be observed through quantifiable patterns such as login regularity, time spent on learning materials, interaction with assessments, engagement in forums, response rates to feedback, and pacing of task completion.

These behavioral indicators reveal distinct motivational profiles. Consistent voluntary activity, revisiting of materials, engagement with optional resources, and proactive communication typically correspond to intrinsic motivation, autonomous regulation, and higher self-efficacy. In contrast, activity peaks occurring close to deadlines, reduced participation in non-mandatory components, and patterns of minimal compliance often indicate extrinsic or controlled forms of motivation [3]. LMS-generated data thus provide a unique opportunity to map theoretical motivational constructs onto

measurable patterns, transforming raw digital traces into meaningful pedagogical insights. This alignment is essential for understanding not only whether students are active, but how and why they engage in particular ways.

The analytic capacity of LMS platforms plays a crucial role in this transformation. Activity logs capture fine-grained chronological information, including timestamps, device types, navigation sequences, and time-on-task metrics, which allow researchers to differentiate between sustained and sporadic engagement. In addition, modern LMS include advanced analytics dashboards that visualize academic progress, activity trends, and comparison with cohort norms [4]. Such dashboards provide instructors with timely indicators of declining motivation, enabling early intervention before reduced engagement results in academic underperformance or withdrawal.

Subjective data, collected through built-in survey modules and feedback tools, complement these behavioral metrics. Although self-reported motivation may be influenced by individual perceptions or response biases, its triangulation with objective behavioral data significantly enhances the validity of motivational assessment. Students' reflections about confidence, interest, task value, or perceived difficulty become particularly meaningful when they align—or notably diverge—from actual behavioral patterns recorded within the LMS.

Gamification mechanisms represent another valuable component of LMS-based motivational assessment. Badges, leaderboards, progress bars, and reward systems serve not only as motivational stimuli but also as diagnostic indicators [4]. Patterns of earning, ignoring, or abandoning gamified tasks reveal shifts in students' engagement strategies and motivational states. Furthermore, adaptive learning systems and recommendation engines provide insights into persistence, willingness to repeat difficult tasks, and receptiveness to personalized pathways—dimensions strongly associated with intrinsic motivation and growth-oriented learning behaviors.

These diverse data streams are integrated and interpreted through methods of educational analytics, which combine statistical analysis, machine learning, and advanced visualization techniques. Cluster analysis can identify groups of learners with distinct motivational profiles—consistently engaged,

deadline-driven, minimally active, or erratic. Predictive models, such as logistic regression, random forests, and neural networks, can forecast motivational decline based on early activity patterns, enabling proactive instructional interventions [5]. Sequential pattern analysis reveals habitual tendencies such as deep engagement, strategic skimming, or avoidance of certain types of learning tasks. This analytic ecosystem allows instructors to move beyond intuition and adopt evidence-based strategies to strengthen student motivation.

The practical application of LMS-based motivational analytics requires adherence to several methodological principles. Triangulation of data sources is essential, combining behavioral logs, academic performance indicators, and self-reported motivation to ensure robust interpretation [5]. Regular monitoring and timely pedagogical responses are necessary to prevent early signs of disengagement from developing into long-term academic difficulties. Transparency is also crucial: students should understand how their data are used and be encouraged to engage with personal analytics dashboards to support self-regulated learning. The integration of adaptive learning tools must be designed not only to enhance performance but also to reinforce autonomy, competence, and interest—the core drivers of intrinsic motivation. Finally, ethical considerations must guide all stages of data collection and analysis, ensuring confidentiality, informed consent, and responsible use of motivational indicators.

Collectively, these approaches demonstrate that LMS platforms—enhanced by educational analytics—constitute a powerful instrument for diagnosing, interpreting, and supporting the motivational processes of higher education students [6]. By transforming behavioral traces into meaningful insights, predicting motivational risks, and enabling personalized pedagogical strategies, LMS technologies significantly enrich the capacity of digital and blended learning environments to sustain and develop student motivation.

Conclusion. Learning Management Systems offer extensive opportunities for monitoring and interpreting motivational indicators of higher education students. LMS activity logs, analytics dashboards, surveys, and adaptive learning features enable the collection of multidimensional data that reflect both intrinsic and extrinsic aspects of motivation. When processed

through learning analytics and machine learning techniques, these data provide valuable insights into engagement patterns, risks of motivational decline, and students' readiness for self-regulated learning.

The integration of LMS-based motivational analytics into educational practice contributes to the development of flexible, student-centered learning environments. It enables educators to provide personalized support, improve course design, and enhance the overall effectiveness of digital and blended learning. Thus, LMS tools serve not only as technological platforms but also as strategic instruments of pedagogical management.

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