EXPLORING LEARNING ENGAGEMENT FACTORS INFLUENCING BEHAVIORAL, COGNITIVE, AND EMOTIONAL ENGAGEMENT AND CHALLENGES IN LEARNING MANAGEMENT SYSTEMS

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ABSTRACT

Learning Management Systems (LMS) have become central to modern education, offering flexible and interactive platforms for delivering content. Yet, fostering behavioral, cognitive, and emotional student engagement within these systems remains a persistent challenge. This study conducts a comprehensive literature review to examine the factors influencing student engagement in LMS environments and to identify key obstacles. As expected, factors such as intuitive user interface design, timely instructor feedback, and the inclusion of interactive content were consistently associated with higher engagement, which aligns with common pedagogical understanding. More surprisingly, the review highlights the critical impact of less obvious factors, including psychological elements like peer support, intrinsic motivation, and the perceived relevance of tasks, which are often underemphasized in LMS design. Additionally, challenges such as cognitive overload, limited personalization, and inadequate scaffolding mechanisms emerged as significant barriers to effective engagement. This paper contributes by mapping out the existing research landscape and offering practical insights for educators, LMS developers, and institutional stakeholders. It underscores the importance of a holistic, student-centered approach to LMS implementation that goes beyond technical functionality to address the diverse needs of learners.

KEYWORDS

Learning Management Systems (LMS), Learning Engagement Factors, Behavioral, Cognitive, and Emotional Engagement

1. INTRODUCTION

In today's digital landscape, Learning Management Systems (LMS) have become essential in modern education, providing platforms that facilitate access to course materials, enable seamless communication, and promote collaboration among learners and instructors. Some examples are Moodle, Blackboard, Canvas, Google Classroom, and Schoology. These systems have significantly transformed traditional educational environments by offering flexibility and accessibility, extending learning opportunities to diverse populations (Al-Fraihat et al., 2020)(Dhawan, 2020). However, the success of LMS is closely tied to its ability to foster meaningful student engagement. Engagement in LMS environments is typically divided into three key dimensions: behavioural, cognitive, and emotional engagement. Behavioural engagement refers to students' active involvement in learning activities, cognitive engagement involves intellectual investment and effort, while emotional engagement captures the

motivational and affective aspects of the learning experience (Henrie et al., 2015) (Redmond et al., 2018).

Student engagement is significantly influenced by both Learning Management Systems (LMSs) and e-learning environments; however, current research suggests that LMSs play a more direct and measurable role in shaping and tracking this engagement. LMS usage allows for detailed monitoring of student activities, such as logins, access to course materials, assignments, and forum participation, which serve as key indicators of engagement levels levels (Ahmadi et al., 2023) (Pinar & Choate, 2023) Studies consistently show a positive correlation between LMS use and student performance, with LMS implementation leading to higher engagement scores (Pirani, S. A., & Patil, 2024) and accurate predictions of learning outcomes (Jiang & Liu, 2022) . LMS platforms provide essential structure to e-learning by supporting content delivery, communication, and assessment, enhancing access and interaction within the learning process (Zanjani et al., 2017) . While e-learning offers flexibility and diverse content delivery, LMSs act as the operational core, recording behaviors and supporting structured learning pathways, directly impacting engagement (Mahmoud et al., 2021) (Subiyantoro et al., 2024).

Despite the transformative potential of LMS, fostering sustained engagement among learners presents significant challenges. Factors such as limited interactivity, inadequate feedback mechanisms, and varying levels of digital literacy often hinder effective engagement. Additionally, addressing the interconnected dimensions of engagement—behavioural, cognitive, and emotional—requires a comprehensive approach that many LMS platforms lack (Hew et al., 2020)(Martin & Bolliger, 2018). These challenges highlight the importance of understanding the underlying factors that promote engagement and the obstacles that impede its development in LMS environments.

This study aims to investigate the factors influencing learner engagement within LMS platforms and to identify the specific challenges that impact each dimension of engagement: behavioral, cognitive, and emotional. By examining these aspects, the research seeks to provide actionable insights to enhance the design and implementation of LMS. The study focuses on engagement within higher education contexts, acknowledging learners' diverse learning needs and technological capabilities. While offering broad recommendations, the research also considers limitations such as the variability of institutional resources and the dynamic nature of educational technologies (Zhu et al., 2020) .

The findings from this study contribute to the expanding body of knowledge on LMS by illuminating the complex nature of learner engagement and its influencing factors. Identifying key challenges and actionable solutions, this research offers valuable guidance for educators, LMS developers, and policymakers. These insights aim to improve LMS effectiveness, thereby enhancing learning outcomes and facilitating the broader integration of technology in education (Ryan & Deci, 2000) (Sun & Rueda, 2012).

2. METHOD AND MATERIALS

This study adopts a systematic literature review (SLR) approach to identify, analyze, and synthesize existing research on issues and challenges related to learner engagement in Learning Management Systems (LMS). The systematic approach ensures a comprehensive and unbiased exploration of the topic, enabling the identification of patterns, gaps, and trends in the literature.

2.1. Search Strategy

The literature review employed a comprehensive search strategy to identify relevant studies on issues and challenges related to learner engagement in Learning Management Systems (LMS). The search was conducted across multiple academic databases, including Scopus, Web of Science, IEEE Xplore, SpringerLink, and Google Scholar, ensuring access to a wide range of high-quality and peer-reviewed articles. To ensure inclusivity, a combination of keywords and Boolean operators was used. The search terms included phrases such as "learner engagement" AND "LMS," "behavioral engagement" OR "cognitive engagement" OR "emotional engagement," "challenges" AND "Learning Management Systems," and "e-learning" OR "online education" AND "engagement factors." These keywords were chosen to capture various dimensions of engagement and challenges in LMS environments.

Explicit inclusion and exclusion criteria were applied to refine the selection of articles. The inclusion criteria focused on peer-reviewed articles published 10 years ago, studies addressing behavioral, cognitive, or emotional engagement in LMS, and articles explicitly discussing challenges related to LMS engagement. In contrast, the exclusion criteria eliminated studies unrelated to LMS or learner engagement and articles without full-text access or empirical evidence. The screening process was conducted in two stages. First, the titles and abstracts of the articles were reviewed to identify potentially relevant studies. Second, a full-text screening was conducted to ensure the selected articles met the inclusion criteria.

2.2. Data Collection

Relevant data were systematically extracted from the selected articles using a predefined extraction form. The extracted data included study objectives, methodologies, factors influencing learner engagement (behavioral, cognitive, emotional), identified challenges in LMS engagement, and recommendations for addressing these challenges. The extraction process ensured a consistent and comprehensive analysis of the selected literature. Additionally, the quality of each included study was assessed based on criteria such as the clarity of objectives, methodological rigor, and relevance to the research questions. This quality assessment ensured the findings were based on reliable, high-quality studies.

2.3. Data Analysis

The collected data were analyzed using thematic and descriptive synthesis methods. Thematic analysis was employed to identify recurring patterns and issues related to learner engagement in LMS, focusing on themes such as factors contributing to engagement, barriers to effective engagement, and challenges in technological, instructional, and social contexts. These themes provided a structured understanding of the critical issues affecting engagement in LMS environments. Following the thematic analysis, a narrative synthesis was conducted to summarize the findings across studies. This synthesis highlighted common challenges, proposed solutions, and insights into improving learner engagement in LMS. Finally, a gap analysis was performed to identify areas where existing research is limited, offering directions for future investigations. Combining these analytical approaches ensured a comprehensive understanding of the topic, providing valuable insights for educators, researchers, and LMS designers.

3. RESULTS AND DISCUSSION

This section discusses the highlighted learning engagement factors and challenges that influence behavioral, cognitive, and emotional engagement in learning management systems based on the literature reviewed in the previous section.

3.1. Factors Influencing Engagement

Multiple technological, pedagogical, and psychological factors shape engagement in Learning Management System (LMS) environments. Among these, gamification and gamified learning have emerged as innovative pedagogical strategies that directly influence engagement by reshaping instructional content delivery and fostering active participation.

- **Technological Factors**

LMS platforms are the technological foundation for delivering educational content and facilitating interactions. The design and functionality of LMS platforms significantly impact engagement. Features like intuitive user interfaces, interactive tools, and system reliability are essential for seamless learning experiences (Bond et al., 2021). For instance, integrating gamified elements into an LMS has been shown to enhance student engagement by making learning experiences more interactive and motivating. Gamification complements these technological elements by leveraging advanced features like leaderboards, achievement badges, and progress trackers, which are integrated into LMS platforms to provide an interactive and personalized learning environment. The implementation of gamified tools not only enhances usability but also aligns with technological advancements to promote learner-centered engagement.

Gamification has been identified as an effective technological factor for enhancing learner engagement in Learning Management Systems (LMS) due to its ability to leverage intrinsic and extrinsic motivational elements. By incorporating game-like mechanics such as points, badges, leaderboards, and challenges, gamification transforms routine learning activities into interactive and rewarding experiences (Xiao & Hew, 2024) , driving engagement across behavioral, cognitive, and emotional dimensions. Table 1 describes studies on gamification across dimensions.

Table 1: Studies on gamification and online learning across dimensions

Articles	Behavioural Engagement	Cognitive Engagement	Emotional Engagement	Motivational Engagement
(Xiao & Hew, 2024)	/	/		/
(Dichev et al., 2020)				/
(Ourdas & Ponis, 2023)	/			
(Asiksoy & Canbolat, 2021)	/	/		
(Alsubhi & Sahari, 2020)	/	/	/	
(Alfaqiri et al., 2020)	/	/	/	
(Bouchrika et al., 2021)	/	/		
(Schöbel et al., 2023)		/	/	
(Esichaikul & Jayalath, 2020)	/	/	/	/
(Tu et al., 2025)			/	
(Meng et al., 2024)	/	/	/	

Gamification exemplifies how technological factors can directly impact learner engagement in LMS environments. Educators and instructors can create an interactive, motivating, and personalized learning experience that addresses behavioral, cognitive, and emotional engagement by integrating game-like features into the LMS (Rivera & Garden, 2021)(Amin, M. M., Shamsuddin, S. N. W., & Hamzah, 2024). The evidence from these studies underscores gamification's potential to transform passive learning into an active and fulfilling process.

- **Pedagogical Factors**

Pedagogical factors focus on effective instructional design and teaching strategies. Elements like timely feedback, collaborative activities, and the integration of multimedia resources promote active participation and support cognitive and emotional engagement. Aligning course content with learners' learning needs also improves the relevance and impact of LMS-based instruction (Martin & Bolliger, 2018).

Effective instructional design and teaching strategies are central to engagement, with gamification and gamified learning forming critical components. These approaches involve integrating game mechanics, such as points, badges, and levels, into learning activities to motivate learners and sustain their interest. Gamification encourages active participation by transforming traditional content into interactive, goal-oriented tasks, enhancing behavioral and cognitive engagement. Additionally, immediate feedback, collaborative tasks, and competitive elements foster teamwork and critical thinking, further enriching the learning experience (Martin & Bolliger, 2018). Personalization, a hallmark of effective pedagogy, is also facilitated through gamified learning, as it adapts to individual learner needs and preferences.

- **Psychological Factors**

Motivation, self-efficacy, and a sense of community are critical psychological determinants of engagement. Intrinsic motivation and a belief in one's ability to succeed (self-efficacy) drive sustained effort and persistence. A supportive online community also enhances emotional engagement by reducing feelings of isolation and fostering connections among learners (Sun & Rueda, 2012). Psychological determinants, such as motivation, self-efficacy, and a sense of community, are vital for emotional engagement. Gamification addresses these factors by offering rewards and recognition for achievement, boosting intrinsic motivation, and fostering a sense of accomplishment. Moreover, gamified activities often promote a supportive and interactive online community, reducing feelings of isolation and enhancing emotional connection among learners (Sun & Rueda, 2012) . These psychological benefits of gamification are integral to creating a holistic and engaging learning environment.

These factors create a comprehensive framework for understanding and enhancing engagement in LMS environments. When these factors are aligned and integrated, they not only address the diverse needs of learners but also mitigate common barriers to engagement, such as lack of motivation, poor usability, and the digital divide. This holistic approach enables educators and LMS designers to create enriched learning environments that cater to behavioral, cognitive, and emotional dimensions of engagement, ultimately leading to improved learning outcomes and greater learner satisfaction. By leveraging this comprehensive framework, stakeholders in education can better address challenges and unlock the full potential of LMS as a transformative tool for modern education.

3.2. Challenges in LMS Engagement

While LMS offers significant opportunities for enhancing education, several challenges hinder effective learner engagement. Despite its potential, LMS engagement is often hampered by challenges such as a lack of motivation, accessibility issues, inadequate scaffolding mechanisms (Njuguna & Joyce, 2022), and complex interfaces. Motivation is another critical issue, as sustaining learner interest in an online setting is often challenging due to the absence of physical interaction and the distractions inherent to virtual environments (Bond et al., 2021). Limited access to reliable internet and appropriate devices remains a significant obstacle for many learners, particularly in underprivileged regions or during periods of emergency remote learning, where digital resources are crucial (Dhawan, 2020).

Additionally, the usability of Learning Management Systems (LMS) often poses challenges; poorly designed or overly complex interfaces can frustrate users, making it difficult for learners to navigate the platform effectively, which can, in turn, hinder active participation (Zhu et al., 2020). Furthermore, technological access and digital literacy disparities contribute to a digital divide, creating inequities in engagement levels and exacerbating challenges for learners with limited technological exposure (Redmond et al., 2018). Together, these barriers highlight the multifaceted nature of engagement challenges in LMS environments. Gamification addresses many challenges by making learning more interactive and user-friendly, bridging the technological and pedagogical design gap. Through a thorough review of existing frameworks and engagement strategies, several gaps were identified that needed to be addressed:

- **Limited Focus on Engagement in Existing LMS Frameworks**

Learning Management Systems (LMS) have become integral tools in education, facilitating content management, communication, and assessment in online learning environments. However, one critical issue often observed is the limited focus on fostering learner engagement within traditional LMS platforms. Traditional LMS platforms prioritize content delivery, administrative functions, and course materials management. These systems typically offer features such as content repositories, quizzes, discussion boards, and grade books. While these functionalities are essential for managing course logistics, they often must catch up in actively engaging learners. Learner engagement, which encompasses motivation, interaction, and participation, is critical to achieving positive educational outcomes. Traditional LMS platforms emphasize content consumption over interaction and collaboration, need mechanisms to sustain learners' motivation throughout a course, and rely on passive assessment methods that may not fully capture the depth of engagement.

Gamification presents an opportunity to address the limited focus on engagement within traditional LMS platforms. Gamification involves incorporating game-like elements, such as points, badges, leaderboards, and challenges, into non-game contexts, including education. When integrated effectively, these elements can enhance learner engagement by providing clear goals and rewards to motivate learners, offering a sense of achievement and progress tracking, and creating opportunities for competition, collaboration, and social interaction.

Gamification principles align with Self-Determination Theory (SDT), which emphasizes autonomy, competence, and relatedness as key factors in motivating learners. By integrating gamified elements, LMS platforms can better satisfy these psychological needs, fostering intrinsic motivation and engagement. Incorporating gamification into LMS platforms should be done thoughtfully, considering the specific needs and goals of the course and the learner population. Besides, many existing frameworks lacked empirical testing in actual LMS environments. The framework incorporated an expert review process to validate its structure and

components, ensuring adaptability and effectiveness for diverse educational settings (Wang et al., 2024) (P. olit, D.F. and Beck, 2005).

- **Deficiency of Metrics for Learning Analytics Engagement:**

In online education, measuring and understanding learner engagement is crucial for improving the quality of educational experiences. Learning analytics, which involves collecting and analyzing data related to learner activities, has become instrumental in assessing engagement. However, there is a significant need for improvement in the metrics used for learning analytics engagement. Current learning analytics metrics often exhibit the following limitations:

a) Quantitative Emphasis: Many existing metrics rely heavily on quantitative data, such as the number of logins, time spent on tasks, or completion rates. While these metrics offer valuable insights, they overlook the qualitative aspects of engagement, such as the depth of interaction, critical thinking, or the quality of contributions.

b) Limited Emotional Insight: Engagement is not solely a cognitive or behavioral phenomenon; it also involves emotional components like motivation, interest, and satisfaction. Current metrics often fail to capture the emotional nuances of engagement, which can significantly impact the learning experience.

c) Contextual Blind Spots: Metrics may not consider the context in which engagement occurs. Learners may exhibit varying levels of engagement depending on the content, course design, or instructional methods. Static metrics may not account for these contextual variations.

d) Intrinsic Motivation Neglect: Traditional metrics may not effectively capture intrinsic motivation—the internal drive to learn for the sake of learning. Intrinsic motivation is a key driver of sustained engagement, yet conventional analytics may not adequately assess it.

To address the deficiency of metrics for learning analytics engagement, the integration of gamified elements within educational platforms offers a promising solution. Gamification can enhance engagement data collection by:

a) Behavioral Insights: Gamified elements, such as points, badges, and leaderboards, can capture behavioral data about learner actions, interactions, and progress within the platform. These elements offer quantifiable indicators of engagement.

b) Emotional Data: Gamification can assess emotional data by monitoring learner reactions to challenges, rewards, and feedback. Emotions like satisfaction, frustration, curiosity, and motivation can be tracked, providing a more nuanced understanding of engagement.

c) Contextual Adaptation: Gamification elements can be designed to adapt to the context of the learning environment. Contextual cues can trigger specific gamified features when learners encounter challenging content or require additional motivation.

Previous case studies illustrate how gamification can provide valuable additional dimensions of engagement data, including behavioral patterns, emotional responses, and the effectiveness of gamified elements in motivating learners (Ismail et al., 2021) (Deterding et al., 2011) (Hamari et al., 2014). Educators and institutions can obtain a more comprehensive and nuanced understanding of learner engagement by incorporating gamification into learning analytics, enabling data-driven decisions to enhance the online learning experience.

- **Limited Multidimensional Learning Engagement Evaluation**

Existing strategies often focused on a single dimension of engagement, such as behavioral participation, while neglecting cognitive and emotional aspects. The proposed framework comprehensively addressed this gap by designing activities and gamified elements to target all three dimensions. In online education, assessing and understanding learner engagement is a fundamental concern. Learner engagement directly impacts learning outcomes, retention rates, and overall course satisfaction. However, one critical challenge is the limited of a comprehensive and multifaceted evaluation approach that can effectively measure and analyze learner engagement.

A multifaceted evaluation approach for assessing learner engagement aims to provide a comprehensive and nuanced understanding of how learners interact with course content and activities. It goes beyond traditional metrics by considering various dimensions of engagement, including behavioral, emotional, and cognitive aspects. This approach recognizes that engagement is a multifaceted phenomenon that requires a holistic evaluation to inform instructional improvements and enhance the learning experience.

The evaluation dimensions of engagement can be described as follows:

a) Behavioral Engagement: This dimension assesses observable actions and behaviors of learners within the course. It includes metrics such as the frequency of logins, participation in discussions, completion of assignments, and adherence to deadlines. Behavioral engagement measures the extent to which learners actively participate in learning

b) Emotional Engagement: Emotional engagement pertains to the affective and emotional aspects of the learning experience. It assesses learners' interest, enjoyment, motivation, and satisfaction during the course. Methods to measure emotional engagement may include surveys, sentiment analysis of forum posts, or self-reporting by learners

c) Cognitive Engagement: Cognitive engagement involves learners' mental effort and intellectual involvement in learning tasks. It assesses the depth of understanding, critical thinking, problem-solving, and knowledge application. Evaluation methods for cognitive engagement may include assessment performance, quality of contributions in discussions, and self-assessment of learning goals (Appleton et al., 2006).

The interplay between behavioral, cognitive, and emotional engagement reveals the interconnected nature of these dimensions. For example, behavioral participation often facilitates cognitive engagement by encouraging learners to actively process and apply information, while emotional engagement motivates sustained effort and commitment to learning tasks. The findings emphasize that engagement cannot be fully understood or addressed in isolation; a holistic approach is necessary to create impactful learning experiences.

Implementing a multifaceted evaluation approach requires various tools and methods tailored to each dimension of engagement. Some examples include:

- Learning Analytics Platforms: Learning analytics tools can capture behavioral engagement data, such as logins, time spent on tasks, and completion rates.

- Surveys and Questionnaires: Surveys can be designed to assess emotional engagement, allowing learners to provide feedback on their motivation, satisfaction, and interest in the course.

- Rubrics and Assessment Tools: Rubrics can be used to evaluate the quality of learners' contributions, indicating their level of cognitive engagement.

- Natural Language Processing (NLP) Tools: NLP can analyze the sentiment and tone of text-based interactions in online forums to gauge emotional engagement.

Previous studies illustrate how a comprehensive evaluation approach enhances our understanding of learner engagement and informs instructional strategies for better outcomes. By systematically addressing these gaps, the framework design process ensured a robust solution that aligns with current educational needs and challenges. Using theoretical models provided a scientific basis for the framework, while the iterative refinement process through expert feedback ensured practical applicability.

3.3. Theoretical Framework/Model in Engagement Studies in the LMS Environment

This study is grounded in relevant theoretical models that provide insights into engagement mechanisms in LMS environments, as shown in Table 1. By integrating these theoretical perspectives, the study aims to comprehensively understand the factors influencing engagement and address learners' and instructors' challenges in LMS environments.

Table 2: The theoretical framework/model in engagement studies in the LMS environment

Theoretical Framework/ Model	**Description**	**Core Elements**	**Related Engagement Type**	**Related Study**
Self-Determination Theory (SDT)	Explains motivation in terms of autonomy, competence, and relatedness.	Autonomy, competence, relatedness.	Behavioral, Cognitive, Emotional.	(Ryan & Deci, 2020): *Self-determination theory and the facilitation of intrinsic motivation*.
Engagement Theory	Emphasizes collaborative, project-based, and meaningful learning tasks	Collaboration, interaction, authentic learning tasks.	Behavioral, Social.	(Kearsley & Shneiderman, 1998): *Engagement Theory: A framework for technology-based teaching*.
Flow Theory	Describes the state of being fully immersed and focused in an activity.	Challenge-skill balance, intrinsic motivation, feedback.	Cognitive, Emotional.	(Csikszentmihalyi, 1990): *Flow: The psychology of optimal experience*.
Cognitive Load Theory	Examines how cognitive resources are used during learning activities.	Intrinsic load, extraneous load, germane load.	Cognitive.	Sweller (1988) (Csikszentmihalyi, 1990) : *Cognitive load during problem solving: Effects on learning*.

Theoretical Framework/ Model	Description	Core Elements	Related Engagement Type	Related Study
Social Constructivist Theory	Suggests that learning occurs through interaction and collaboration with others.	Peer collaboration, instructor guidance, shared knowledge construction.	Social, Cognitive.	Vygotsky (1978) (VYGOTSKY, 1978) : *Mind in society: The development of higher psychological processes*.
Emotional Intelligence Theory	Explores the role of emotions in learning, focusing on emotional regulation and social interaction.	Emotional awareness, empathy, emotional regulation.	Emotional, Social.	(Mayer, J. D., & Salovey, 1997): *What is emotional intelligence?*.
Game-Based Learning Theory	Examines the use of game mechanics to enhance engagement and learning outcomes.	Gamification elements (points, badges, challenges), narrative design.	Behavioral, Cognitive, Emotional.	(Gee, 2003) : *What video games have to teach us about learning and literacy*.
Constructivist Learning Theory	Focuses on learners actively constructing knowledge through experiences.	Active learning, real-world application, critical thinking.	Cognitive, Behavioral.	(Piaget, 1954): *The construction of reality in the child*.

Table 2 shows that various theoretical models offer valuable insights into engagement mechanisms within Learning Management System (LMS) environments, each focusing on specific dimensions of engagement. However, Self-Determination Theory (SDT) stands out as a particularly comprehensive framework because it addresses all three types of engagement—behavioral, cognitive, and emotional—making it highly applicable to holistic engagement strategies in LMS.

- Behavioral Engagement: SDT emphasizes autonomy, allowing learners to take control of their learning activities, thereby promoting active participation. This aligns with behavioural engagement, which involves learners' observable actions in their educational pursuits, such as completing assignments and interacting with LMS tools.

- Cognitive Engagement: The competence aspect of SDT directly supports cognitive engagement by motivating learners to master challenging tasks. Learners who perceive they can achieve learning goals are likelier to invest effort in intellectual activities such as problem-solving and critical thinking.

- Emotional Engagement: SDT's focus on relatedness fosters a sense of belonging and emotional connection among learners. This emotional support enhances motivation, reduces feelings of isolation, and creates a positive learning environment where learners feel valued and supported.

Other models, such as Engagement Theory and Flow Theory, while effective, tend to specialize in specific aspects of engagement, such as collaborative activities or immersive focus, respectively. Similarly, Emotional Intelligence Theory addresses emotional engagement but lacks the breadth to encompass cognitive and behavioral dimensions.

By addressing the interplay between autonomy, competence, and relatedness, SDT provides a robust and integrative framework for understanding and enhancing engagement across all

dimensions. This makes it the most suitable choice for designing comprehensive engagement strategies in LMS environments, as it allows educators and system designers to create interventions that holistically address the needs of learners. Self-Determination Theory (SDT) is the preferred theoretical model for this study because it comprehensively covers behavioral, cognitive, and emotional engagement. Its multidimensional approach enables the design of LMS environments that motivate active participation and foster intellectual growth and emotional well-being. This makes SDT a valuable framework for developing effective pedagogical strategies and technological interventions to enhance engagement in LMS-based learning.

Multiple technological, pedagogical, and psychological factors shape engagement in Learning Management System (LMS) environments. Among these, gamification and gamified learning have emerged as innovative pedagogical strategies that directly influence engagement by reshaping instructional content delivery and fostering active participation. Gamification and gamified learning bridge technological, pedagogical, and psychological factors, making them powerful strategies for enhancing LMS engagement. By addressing challenges and aligning with theoretical frameworks, these approaches improve behavioral, cognitive, and emotional engagement and provide a blueprint for effective and innovative LMS design. The integration of gamification into LMS continues to redefine the learning experience, offering both theoretical and practical contributions to education.

These findings have significant implications for LMS design and pedagogical practices. To enhance engagement, LMS platforms should integrate features that address the diverse needs of learners across all engagement dimensions. Technological improvements, such as user-friendly interfaces and reliable infrastructure, are essential for promoting behavioral engagement. Pedagogical strategies, including interactive content, gamified elements, and well-organized learning pathways, support cognitive and emotional engagement. Furthermore, fostering community and providing personalized learning experiences can strengthen emotional connections and motivation. By addressing these aspects, LMS environments can create comprehensive and practical learning ecosystems that meet the dynamic demands of modern education.

4. CONCLUSION

This study underscores the critical factors influencing engagement in Learning Management Systems (LMS) across behavioral, cognitive, and emotional dimensions. The findings reveal that interactive tools, well-structured content, personalized learning experiences, and a supportive online community are pivotal for fostering effective engagement. Conversely, technical barriers, cognitive overload, and lack of personalization hinder learners' active participation, intellectual investment, and emotional connection to the learning process. These insights highlight the need for comprehensive strategies to address these challenges and optimize LMS environments.

The research contributes significantly to both theoretical and practical domains. Theoretically, it integrates established engagement models, including Self-Determination Theory and gamified learning, to develop a robust framework for understanding engagement in LMS. Practically, it provides actionable recommendations for improving LMS design and instructional practices, emphasizing the importance of holistic approaches that address diverse learner needs. The study offers a comprehensive solution for overcoming engagement challenges and enhancing the learning experience by aligning theoretical insights with practical strategies.

Despite its contributions, this study has limitations, primarily due to its reliance on existing literature, which may not fully reflect emerging trends or the dynamic nature of LMS technologies. Efforts to validate the findings are ongoing, with plans to employ a triangulation

process combining the conceptual framework with expert reviews and empirical studies. Future research should explore diverse educational contexts, examine the long-term effects of engagement strategies, and investigate emerging technologies, such as artificial intelligence, to enhance LMS functionality and personalization. Addressing these gaps will further refine the framework and contribute to the advancement of effective engagement strategies, ultimately enriching learners' learning experiences in digital education environments.

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