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Discovering Student Engagement across Digital Learning Contexts: A Systematic Review

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ABSTRACT

Digital learning has rapidly transformed educational practice and raised important questions about how students engage across technology-mediated learning environments; therefore, this systematic literature review aims to examine how student engagement appears in digital learning contexts, identify psychological factors that support or hinder engagement, and analyze how engagement is measured in recent studies. Following PRISMA 2020 guidelines, this review synthesized 24 peer-reviewed studies published between 2021 and 2025 from Scopus, PubMed, and Google Scholar using thematic synthesis. The findings show that student engagement in digital learning consists of behavioral, cognitive, emotional, and agentic dimensions that operate as an interconnected system rather than isolated components. Social connection, instructor responsiveness, self-efficacy, structured interaction, and psychologically safe learning environments were found to support engagement, whereas social isolation, low psychological safety, weak instructional design, excessive flexibility without structure, and digital distraction reduced student involvement. The review also found that engagement measurement remains dominated by self-report questionnaires and platform-based analytics, although these methods capture only partial aspects of engagement and often fail to represent its cognitive and emotional depth. The originality of this review lies in its cross-context synthesis of secondary school and university-level digital learning studies by integrating instructional, psychological, social, and methodological perspectives. The findings imply that meaningful digital engagement should be intentionally designed through responsive teaching, structured interaction, and psychologically supportive learning environments, while future research should adopt mixed-method and longitudinal approaches to capture engagement more comprehensively.

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INTRODUCTION

Digital technologies are now a central part of modern education. They have changed how instruction is delivered and how students engage with learning content. This shift accelerated during the COVID-19 pandemic, when many institutions moved to online learning and began using digital platforms as the main mode of instruction (Aguilera-Hermida, 2020; Crompton & Burke, 2023). Online learning includes formats such as synchronous, asynchronous, blended, and microlearning, each offering different levels of flexibility and access (Rajabalee & Santally, 2021). While this expansion has increased educational reach, it also raises a key question about how students engage in digital environments. Understanding this issue is important because access alone does not guarantee meaningful learning.

Student engagement is widely seen as an important indicator of learning quality and academic success. It refers to how actively students participate in learning and how connected they feel to their peers, instructors, and learning environment (Thang et al., 2022; Muzammil et al., 2020). It is closely linked to persistence, cognitive development, and academic achievement (Fredricks et al., 2004; Ribeiro et al., 2019). Engagement is commonly described as multidimensional. Behavioral engagement reflects participation and effort, cognitive engagement reflects depth of understanding, and emotional engagement reflects feelings such as interest and belonging (Fredricks et al., 2004). In digital contexts, frameworks such as the Community of Inquiry highlight the role of cognitive, social, and teaching presence in shaping meaningful learning (Garrison & Arbaugh, 2007). These foundational frameworks can be used to guide how engagement is understood and organized. They also help explain how engagement develops in current digital learning contexts based on recent empirical evidence.

These perspectives show that student engagement is not a fixed trait. It is a dynamic process shaped by the interaction between students, instructors, and the learning environment. Because of this, student engagement can vary across contexts and conditions. However, recent findings on student engagement in digital learning are often inconsistent. Some studies show that online learning can support active participation and improve outcomes, especially through flexible access and interactive tools (Bossman & Agyei, 2022; Pérez et al., 2023). Other studies report reduced social connection and weaker interaction compared to face-to-face learning (Rahman et al., 2023; Al-Amin et al., 2021).

Students often report feeling isolated, having limited interaction with instructors, and missing spontaneous communication (Akpen et al., 2024; Xiao et al., 2024). These mixed findings suggest that student engagement is not determined by technology alone. Instead, it depends on how learning is designed and experienced. Instructional design and teacher presence play a key role in shaping engagement. Students are more likely to participate when learning activities are clearly structured and include opportunities for interaction (Cole et al., 2021). Instructor responsiveness and timely feedback also support motivation and participation (Gopal et al., 2021; Stone, 2019). Psychological factors also influence engagement. Self-efficacy, intrinsic motivation, sense of belonging, and self-regulation support engagement, while fear of evaluation, isolation, and low digital skills can reduce it (Kedia & Mishra, 2023; Yang et al., 2024). These factors do not operate separately but depend on the learning context and design (Xiao et al., 2024).

Another challenge concerns how engagement is measured. Self-report questionnaires are widely used but mainly capture perception and are affected by recall bias (Rajabalee & Santally, 2021; Akpen et al., 2024). Platform data provide behavioral indicators such as login frequency and task completion, but they focus on visible activity and miss cognitive and emotional aspects. Because of this, no single method fully captures engagement. Differences in measurement across studies also make findings difficult to compare. This creates gaps in understanding which forms of engagement matter most for learning outcomes. Despite growing studies, there is still limited synthesis across digital learning contexts. This is especially true for studies comparing secondary school and university students. Many existing reviews focus on specific populations or platforms rather than broader patterns (Akpen et al., 2024).

There is also limited understanding of how instructional, psychological, and contextual factors interact to shape engagement (Xiao et al., 2024). These gaps highlight the need for a more integrated and cross-context review. A clearer synthesis can support both research and practice. This study then addresses these gaps by examining three research question: (1) *How does student engagement appear in different digital learning contexts?*, (2) *What psychological factors support or hinder student engagement in digital learning?*, and (3) *How is student engagement measured in digital learning studies?*

METHOD

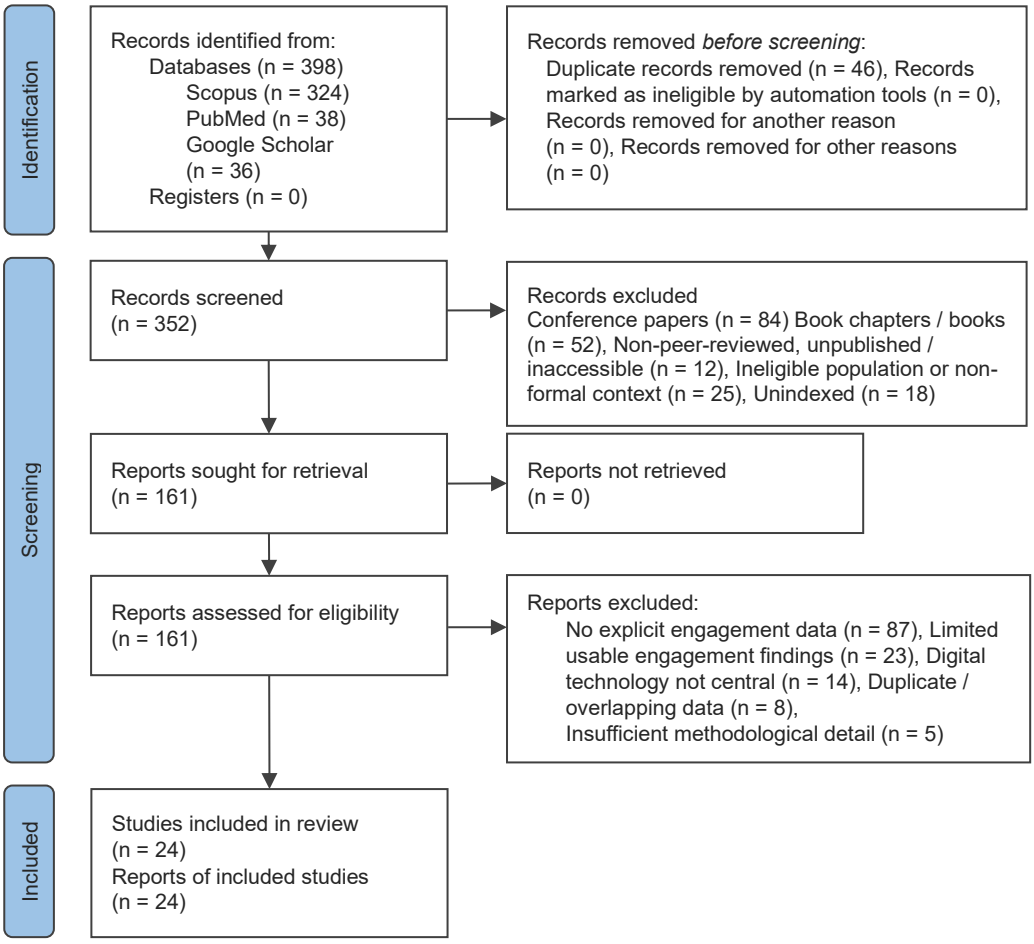
This study used a Systematic Literature Review (SLR) to identify and synthesize studies on student engagement in digital learning. The review followed PRISMA 2020 guidelines (Page et al., 2021) across identification, screening, eligibility, and inclusion stages.

Search Strings

The literature search used two search strings: (SS1) ("student engagement" OR "learning engagement") AND ("digital learning") and (SS2) ("student engagement" OR "learning engagement") AND ("educational technology"). Additional Indonesian terms were also used for national sources, such as "keterlibatan siswa" AND "teknologi digital". These search strings were adjusted to fit the syntax requirements of Scopus, PubMed, and Google Scholar.

Inclusion and Exclusion Criteria

Studies were included if they (1) involved secondary school students, university students, or both; (2) examined digital technology in formal learning settings; (3) explicitly reported student engagement data; (4) were peer-reviewed journal articles; (5) were published between 2021 and 2025; and (6) were written in English or Indonesian. Indonesian journals were required to meet at least SINTA 3 or Scopus indexing standards. The process of selecting articles included in this review is illustrated in Figure 1.



The methodological quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT) 2018 (Hong et al., 2018), and the extracted data were reviewed by all the authors to ensure accuracy. The analysis used an inductive thematic approach, where key findings were coded and grouped into recurring patterns. Disagreements were discussed among all authors. Foundational frameworks, including Fredricks et al. (2004) and Garrison & Arbaugh

(2007), served as theoretical anchors in interpreting the findings, though they fall outside the 2021–2025 inclusion window.

RESULTS AND DISCUSSION

The systematic search and screening process yielded a final selection of 24 peer-reviewed articles published between 2021 and 2025. Initial database searches across Scopus, PubMed, and Google Scholar produced a substantially larger pool of results, which was progressively refined through title and abstract screening and full-text review against specified inclusion criteria. Studies were retained when they explicitly addressed student engagement in digital learning contexts, involved secondary school or university-level participants, and reported original empirical data or systematic synthesis thereof. A comprehensive overview of the included studies is presented in Table 1.

Student Engagement across the Digital Learning Studies

One issue across the reviewed literature is the lack of a unified definition of student engagement in digital learning environments. Different studies define engagement in different ways, leading to differences in variables, measurement approaches, and research conclusions. This makes findings difficult to compare across studies. At the same time, many studies agree that engagement is not simply a fixed student trait. Instead, it emerges through the interaction between students, technology, and instructional design (Li et al., 2023; Suartama et al., 2024; Vilhunen et al., 2025).

From this perspective, behavioral, cognitive, and emotional engagement should be understood as interconnected dimensions rather than separate components. Emotional engagement often becomes the starting point for deeper cognitive engagement. Students who feel disconnected or unmotivated are less likely to engage deeply, even when instructional quality is good (Alghamdi et al., 2024; Bamoallem & Altarteer, 2022; Reguera & Lopez, 2021). At the same time, appropriate cognitive challenges can create positive emotional responses such as interest and enjoyment (Vilhunen et al., 2025; Yakin & Linden, 2021). Behavioral engagement often reflects this interaction, because meaningful participation usually happens when students are both emotionally and cognitively engaged.

Behavioral Engagement across Digital Learning Contexts

Behavioral engagement in LMS environments is usually reflected through visible activity such as login frequency, forum participation, resource downloads, and on-time submissions (Nkomo et al., 2021). Mahmud & Wong (2021) found that engagement appeared through the frequency of posts, replies, chats, and reactions during collaborative learning activities on Microsoft Teams. One student group even organized a virtual meeting outside class hours without instructor instruction. This suggests that the learning structure encouraged initiative beyond simple participation.However, Scott et al. (2021) found a different pattern in a flipped classroom setting. Platform data showed that only 40% of students watched more than half of the pre-class videos. In contrast, survey responses reported much higher viewing activity. This shows that self-reported engagement and actual behavior can differ substantially.

Table 1. Overview of Reviewed Studies

Reference	Level	Digital Context	Dimensions	Psychological Factors	Measurement
1. Aguilar-Cruz (2022)	High School Students	Serious game, English language learning, game learning analytics	Cognitive, emotional, behavioral	Intrinsic play, extrinsic play, motivation, sociocultural background, technology acceptance	Revised MAKE survey, game learning analytics, open-ended questions
2. Ahshan (2021)	University Students	Remote learning, online learning, Moodle, Google Meet, Jamboard, Mentimeter, breakout rooms	Active, social, student interaction	Social presence, motivation, interaction, deep learning, cognitive engagement	Student perception questionnaire
3. Alghamdi et al. (2024)	Medical University Students	eLearning, synchronous learning, asynchronous learning, Blackboard, Zoom, Microsoft Teams	Interaction, engagement	Motivation, personality type, learning style, insecurity	Online questionnaire
4. Balalle (2024)	33 reviewed articles	Gamification, online/distance learning, LMS, Kahoot!, MS Teams, social media	Behavioral, cognitive, emotional	Technology acceptance, digital literacy, social presence, cognitive presence, motivation, frustration	Surveys, observation, academic performance indicators, reviews
5. Bamoallem & Altarteer (2022)	University students	Remote emergency learning, blended learning, online learning	cognitive presence, teaching and social presence	effort expectancy, facilitating conditions, technology acceptance, social presence, cognitive presence	Survey, CoI, UTAUT
6. Gunning et al. (2022)	University Students	Team-based assessment, EdTech, FeedbackFruits, online peer-assessment	Behavioral, collaborative	Accountability, feedback literacy, self-regulation, reflection	Self- and peer-assessment, LMS/EdTech analytics, student feedback
7. Hazzam & Wilkins (2023)	University Students	Online learning, educational technology, online classrooms	Behavioral, emotional, cognitive	Self-efficacy, satisfaction, charismatic leadership	Online survey, SEM questionnaire
8. Istijanto & Nathalie (2024)	Undergraduate & Postgraduate Students	Online learning, face-to-face learning, hybrid learning	Behavioral, emotional, cognitive	Learning effectiveness, social interaction, campus life experience, physical wellness, technological learning, green attitude, flexibility, efficiency	Online questionnaire, Likert scale, semantic differential scale
9. Kedia & Mishra (2023)	Undergraduate & Postgraduate Students	Online learning, e-learning, social media	Behavioral and cognitive	Instructor-student interaction, peer interaction, social media use, family support, technical support	Questionnaire and SEM analysis
10. Li et al. (2023)	Undergraduate students	Emergency online learning (synchronous video-based online learning)	Cognitive presence, social and teaching presence	Conscientiousness, openness, sense of community, nonverbal immediacy, camera use frequency, time management, digital skills, health status	Online survey, qualitative open-ended responses/interviews

Table 1. (Continued)

Reference	Level	Digital Context	Dimensions	Psychological Factors	Measurement
11. Mahmud & Wong (2021)	University Students	Microsoft Teams, online learning, jigsaw method, synchronous/asynchronous learning	Behavioral, collaborative, cognitive	Motivation, interaction, collaboration	Learning analytics, post-test data, student responses
12. Mawarni & Hartoto (2025)	University students (ICT course)	LMS-based blended/online learning using H5P interactive micro-video	Participation	Cognitive load, self-efficacy, motivation, support	LMS completion analysis/logs, descriptive qualitative analysis, quiz scores
13. Meng et al. (2024)	Online learners (higher education context)	Gamified online learning via CourseNetworking platform (Points, Badges)	Skills, emotional, participation, performance	Motivation (via gamification rewards), perception of gamification	Questionnaire/survey, mixed-method (survey + perceptions)
14. Muali & Karlina (2025)	University students (3rd & 5th semester)	Microlearning integrated into digital platform/LMS	Cognitive, affective, behavioral	Motivation, retention, self-regulated learning	Student Engagement Scale questionnaire (Likert), pretest-posttest (quasi-experiment)
15. Nkomo et al. (2021)	30 reviewed articles (Higher Education studies)	LMS, social media, lecture capture technologies	Behavioral, cognitive, social	Motivation, digital literacy, learning preferences, psychological investment	Self-report surveys/scales, mixed methods, analytics
16. Reguera & Lopez (2021)	Medical Students	Distance education, Zoom, digital whiteboard, synchronous online classes	Behavioral, emotional	Interaction, collaboration, active learning	Online survey, Likert-scale questionnaire
17. Scott et al. (2021)	Dental Students	Flipped classroom, LMS, Panopto video lectures	Behavioral, cognitive	Self-directed learning, active learning	Questionnaire, LMS analytics, log data
18. Suartama et al. (2024)	University students	Moodle LMS (gamified/project-based learning environment)	Skills, emotions, participation, performance	Motivation (gamification), engagement via game elements	Questionnaire (25-item Likert student engagement instrument), objective test (learning achievement)
19. Teto & Pule (2022)	University Students & Lecturers	Social media learning, WhatsApp, YouTube, Zoom Meeting	Behavioral	Technology use, social media use	Questionnaire

Table 1. (Continued)

Reference	Level	Digital Context	Dimensions	Psychological Factors	Measurement
20. Vilhunen et al. (2025)	University students (climate education online courses)	Online university courses (Climate University network); asynchronous LMS + synchronous sessions	Cognitive, Emotional, and Situational	Situational interest, perceived skill, perceived challenge, autonomy, relatedness	Ecological momentary assessment (EMA; repeated self-report)
21. Yakin & Linden (2021)	Undergraduate Dental Students	Adaptive e-learning platform, Smart Sparrow, virtual microscopy	Cognitive, behavioral, emotional	Motivation, perceptions, perceived knowledge	Questionnaire, Likert scale, analytics, exam scores
22. Yang et al. (2024)	University students (preparatory international)	Online learning platform; Science & Technology Chinese course (LMS-based)	Behavioral, cognitive, emotional	Academic self-efficacy, basic psychological needs satisfaction, perceived usefulness of technology, course difficulty, assignment completion	Self-report survey (Likert scale)
23. Yorganci (2025)	Preliminary undergraduate (vocational college, mathematics course)	Online flipped learning; Moodle LMS; BigBlueButton (synchronous discussions); asynchronous forum	Behavioral, cognitive, emotional	Self-regulation, online discussion type (synchronous vs. asynchronous), learning approach	Self-report questionnaire
24. Zhang & Li (2024)	University students	Online gamified learning platforms (gamification elements integrated into online courses)	Behavioral	Performance expectancy, perceived fun, habit, immersive experience, subjective norm, perceived behavioral control, learning style	Self-report survey (Likert scale)

Balalle (2024) on gamified learning explained that gamification structures participation through reward-based mechanics. Aguilar-Cruz (2022) tracked mission completion, answer accuracy, and time-on-task across individual and group play conditions. Students in group-play conditions showed higher engagement across all indicators. Meng et al. (2024) also found that point-based rewards maintained behavioral engagement more consistently than badge systems.

Microlearning platforms showed similar results. Mawarni & Hartoto (2025) reported a participation rate above 90% and a 100% task completion rate. Muali & Karlina (2025) also found significant increases in engagement scores after implementation. These findings suggest that short and focused learning units make engagement easier to initiate and maintain.

Several studies caution that visible activity does not always reflect meaningful learning. Behavioral engagement is easy to track, but it does not guarantee understanding or deep learning (Nkomo et al., 2021). Students may complete tasks or access materials while remaining mentally disengaged (Kedia & Mishra, 2023; Li et al., 2023; Scott et al., 2021).

Cognitive Engagement across Digital Learning Contexts

Cognitive engagement is often most visible in adaptive and interactive learning environments. Hazzam & Wilkins (2023) described cognitive engagement as reading additional materials, studying without exam pressure, and actively seeking learning-related information beyond class requirements. Nkomo et al. (2021) further explained that cognitive engagement involves active mental processing, such as revisiting recorded content and regulating learning pace independently.

Several studies show that cognitive engagement increases when students actively process information rather than passively receive it. Yorganci (2025) found stronger cognitive engagement when flipped learning was combined with synchronous discussion activities. Similarly, Reguera & Lopez (2021) found that collaborative diagram construction during Zoom sessions helped students stay cognitively active and improved their understanding of abstract concepts. Zhang & Li (2024) found that immersive experiences created deep concentration. Students became highly focused and lost track of time. Students were more cognitively engaged when they believed the system could help them achieve learning goals.

However, Vilhunen et al. (2025) argued that cognitive engagement becomes stronger during challenging problem-solving activities. In contrast, Scott et al. (2021) found that many students watched learning videos only shortly before exams for memorization purposes rather than for genuine understanding. Li et al. (2023) also found that self-regulation predicted cognitive engagement in online learning.

Emotional Engagement across Digital Learning Contexts

Emotional engagement is strongly influenced by the emotional and relational quality of the learning environment. Reguera & Lopez (2021) found that real-time instructor interaction created a stronger sense of connection and encouraged attendance. In contrast, Alghamdi et al. (2024) found that students who lacked psychological safety or feared peer judgment were more likely to avoid participation.

Aguilar-Cruz (2022) reported higher emotional involvement during group gameplay, especially among marginalized students. Yakin & Linden (2021) found that students often described adaptive learning as fun and motivating. Meng et al. (2024) similarly showed that point-based rewards made learning feel more meaningful. Zhang & Li (2024) also identified perceived fun as an important emotional factor that increased immersion and sustained engagement.

Online learning studies showed similar patterns. Hazzam & Wilkins (2023) found that emotional engagement predicted learning performance and student satisfaction more strongly than behavioral or cognitive engagement. Nkomo et al. (2021) also found that LMS discussion forums and chats helped students feel connected and supported

Similarly, Bamoallem & Altarteer (2022) found that emotional connection with peers and instructors improved students' attitudes toward blended learning. Istijanto & Nathalie (2024) further showed that students reported higher engagement after returning to face-to-face learning because of the stronger emotional and social atmosphere on campus.

Student Agency within Structured Digital Learning

Agentic engagement remains one of the least explored dimensions in student engagement studies. Mahmud & Wong (2021) found clear examples of student agency when students independently organized virtual meetings outside class hours. Yakin & Linden (2021) found similar patterns, where students voluntarily repeated adaptive learning activities until they achieved mastery. Gunning et al. (2022) found that students actively contributed to the learning process by giving peer feedback and helping maintain discussion quality. Teto & Pule (2022) also found that students independently searched for mathematics tutorials on YouTube, formed WhatsApp study groups, and taught one another outside formal classroom structures.

However, agentic engagement appears fragile when learning environments lack structure. Scott et al. (2021) found that many students in flipped classrooms failed to watch pre-class videos consistently. Some students accessed fewer than half of the available materials, while others avoided them entirely. Similarly, Alghamdi et al. (2024) found that many students in synchronous e-learning settings remained passive even when interaction was expected.

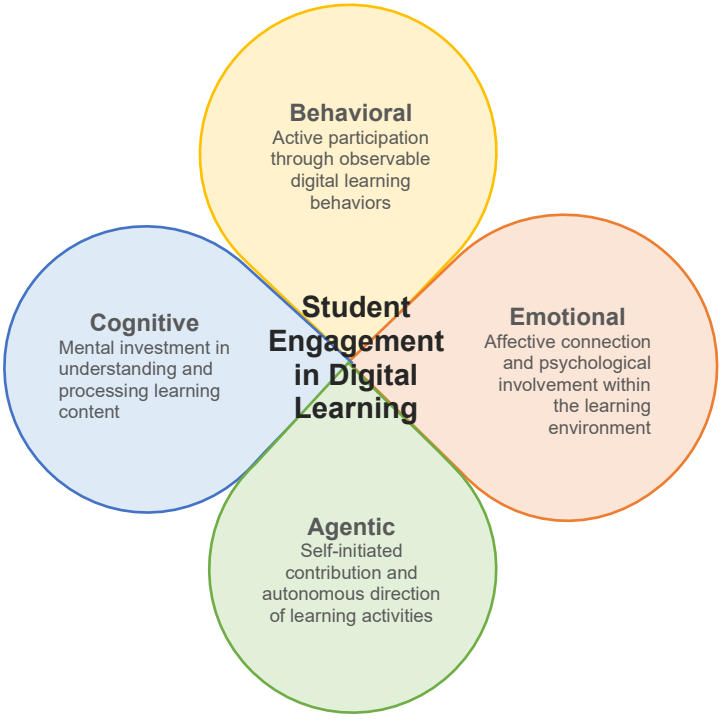


Figure 2. Forms of Student Engagement in the Findings

Factors Shaping Student Engagement in Digital Learning

1) *Social Interaction and Peer Connection*. Across the reviewed studies, social interaction emerged as one of the strongest facilitators of engagement. Collaborative platforms, gamified group activities, peer assessment systems, social media groups, and synchronous learning activities consistently strengthened participation and involvement (Aguilar-Cruz, 2022; Gunning et al., 2022; Mahmud & Wong, 2021; Teto & Pule, 2022; Yorganci, 2025). Istijanto & Nathalie (2024) found that social interaction strongly predicted engagement among students returning to face-to-face learning. Kedia & Mishra (2023) also confirmed

that peer interaction significantly predicted engagement in online university settings. Meanwhile, Zhang & Li (2024) found that students engaged more when peers, family members, and instructors supported the use of gamified learning systems. Synchronous learning activities appeared especially important for building social closeness. Aguilar-Cruz (2022) found that synchronous activities increased students' sense of connection with instructors and peers. Ahshan (2021) similarly found that collaborative tools and structured group discussions improved interaction and cooperation in remote learning settings.

2) *Instructor Quality and Teaching Presence*. Kedia & Mishra (2023) found that instructor–student interaction was one of the strongest predictors of engagement. Alghamdi et al. (2024) reported that delayed instructor responses significantly increased disengagement. Bamoallem & Altarteer (2022) similarly found that teaching presence strongly predicted engagement and positive attitudes toward blended learning. These findings suggest that instructors do more than deliver content in digital learning environments. They also shape the social and emotional climate that supports engagement. Hazzam & Wilkins (2023) found that students engaged more deeply when instructors communicated inspiring goals, showed emotional support, and recognized students' abilities. Emotional engagement showed the strongest relationship, suggesting that students engage more when instructors appear genuinely invested in both the subject and the students.
3) *Technology Integration and Learning Design*. Hazzam & Wilkins (2023) found that engagement increased when lecturers used technology intentionally to support collaboration, interaction, and meaningful learning activities. Meanwhile, Mahmud & Wong (2021) found that learning environments emphasizing autonomy, competence, and social connection created stronger engagement than environments focused mainly on compliance. Vilhunen et al. (2025) similarly found that engagement increased when task difficulty matched students' skill levels.
4) *Academic Self-Efficacy*. Yang et al. (2024) found that students who believed they could succeed invested more effort, persisted longer, and engaged more actively with difficult learning materials. Yakin & Linden (2021) showed that adaptive learning systems strengthened self-efficacy through mastery-oriented feedback. This encouraged students to voluntarily revisit learning materials and improved performance outcomes. The relationship also appeared bidirectional. Balalle (2024) and Ahshan (2021) suggested that peer collaboration, instructor feedback, and clear task structures indirectly strengthened self-efficacy by creating psychologically supportive learning environments. Hazzam & Wilkins (2023) further found that self-efficacy moderated the relationship between lecturer leadership and behavioral engagement. Students with lower self-efficacy depended more heavily on instructional support and learning structure to maintain engagement. Relatedly, Zhang & Li (2024) found that perceived behavioral control also influenced engagement.
5) *Performance Expectancy, Perceived Fun, and Immersive Experience*. Zhang & Li (2024) found that students were more engaged when they believed gamified learning could improve performance and when they enjoyed the learning activities. However, positive perceptions alone only led to stronger engagement when they developed into immersive experiences and repeated participation habits. In other words, students needed to move beyond initial interest toward deeper psychological involvement. Meanwhile, Zhang & Li (2024) found that the absence of immersive experience was strongly associated with lower engagement outcomes. This suggests that focused attention and deep involvement play a central role in sustaining engagement in gamified learning.
6) *Learning Style Compatibility*. Zhang & Li (2024) found that students engaged more deeply when gamified activities matched their preferred learning styles. Students who enjoyed

exploration responded more positively to challenging tasks. Meanwhile, visually oriented students preferred visually rich learning environments.

Barriers to Student Engagement in Digital Learning

Several factors acted both as facilitators and barriers depending on how strongly they were present. Several factors were identified, including peer collaboration and social presence (Bamoallem & Altarteer, 2022; Kedia & Mishra, 2023; Mahmud & Wong, 2021), the type of feedback and level of support received (Alghamdi et al., 2024; Scott et al., 2021), self-efficacy (Yang et al., 2024; Yakin & Linden, 2021), task difficulty (Vilhunen et al., 2025; Zhang & Li, 2024), student autonomy (Mahmud & Wong, 2021; Scott et al., 2021). Meanwhile, the factors mainly discussed as barriers include:

Psychological Safety and Interaction Anxiety. Alghamdi et al. (2024) found that fear of negative peer judgment increased interaction avoidance. Students who felt shy or psychologically unsafe were more likely to avoid participation. Istijanto & Nathalie (2024) similarly found larger GPA declines among shy students after the transition to online learning.

1) *Flexibility without Structure*. Scott et al. (2021) found that unrestricted flexibility in flipped classrooms often reduced engagement rather than supporting self-directed learning. Many students delayed participation until deadlines approached. Mawarni & Hartoto (2025) and Muali & Karlina (2025) also showed that microlearning succeeded not only because it was flexible, but because it combined flexibility with concise and structured learning activities.
2) *Digital Distraction*. Balalle (2024) explained that non-academic digital activities during class negatively affected learning outcomes. In online learning environments, academic tasks compete directly with social media, entertainment platforms, notifications, and multitasking.
3) *Isolation*. Zhang & Li (2024) argued that online learning environments often reduce interpersonal immediacy and spontaneous interaction. Isolation appeared not only as a social issue but also as a structural outcome of online learning systems. As a result, students may feel disconnected from both peers and instructors.
4) *Hawthorne Effect*. Several studies also identified methodological barriers in measuring engagement itself. Nkomo et al. (2021) highlighted the Hawthorne effect, where students change their behavior because they know they are being observed. This means that measured engagement may not always reflect authentic engagement.

Self-Reported Surveys and Questionnaires for Measuring Perceived Student Engagement

Self-reported surveys remain the most commonly used method for measuring student engagement. Many studies used Likert-scale questionnaires to measure behavioral, cognitive, and emotional engagement, as well as related factors such as motivation, satisfaction, and belonging (Bamoallem & Altarteer, 2022; Hazzam & Wilkins, 2023; Kedia & Mishra, 2023; Yang et al., 2024; Zhang & Li, 2024). Several studies used validated frameworks such as the Community of Inquiry survey and the Online Student Engagement scale. Some also tested construct validity and reliability using confirmatory factor analysis (Hazzam & Wilkins, 2023; Zhang & Li, 2024).

However, self-report methods have important limitations. Surveys measure perception rather than actual behavior, and students' perceptions are not always accurate (Nkomo et al., 2021). Scott et al. (2021) showed this clearly by comparing survey responses with LMS analytics. While 71% of students reported watching more than half of the pre-class videos, platform data showed that only 40% actually did so. Some students did not watch any videos at all, even though none reported this in the survey. This gap may result from social desirability bias, inaccurate recall, or limited self-awareness. Because of this, self-report data cannot fully represent actual engagement behavior, especially cognitive and emotional engagement that students may not recognize accurately themselves.

Behavioral and Platform-Based Analytics for Assessing Student Engagement

Mahmud & Wong (2021) analyzed engagement frequency through Microsoft Teams data. Scott et al. (2021) used Blackboard and Panopto logs to track viewing time, re-watch frequency, and viewing patterns. Aguilar-Cruz (2022) also used game analytics to monitor mission completion, answer accuracy, and participation duration in real time. These approaches provide more direct behavioral data than self-report surveys. However, platform analytics still have limitations because they only capture visible activity. A login can show presence, but it cannot measure attention or deep learning.

Nkomo et al. (2021) found that LMS behavioral data did not always align with cognitive or emotional engagement. Similarly, Aguilar-Cruz (2022) noted that incomplete game missions were excluded from the analytics dashboard, which may have overestimated engagement levels. Because of this, behavioral analytics should be interpreted carefully.

Experimental Designs and Structural Equation Modeling for Assessing Student Engagement

Yakin & Linden (2021) compared exam performance between adaptive and non-adaptive learning topics as an indirect measure of cognitive engagement. Yorganci (2025) used a factorial pretest-posttest design to examine the effects of flipped learning and synchronous discussion. Suartama et al. (2024) also compared gamified and non-gamified eLearning conditions. These designs help explain how different instructional approaches influence engagement. However, many studies relied on small and course-specific samples, which limits broader generalization.

Several studies also used structural equation modeling (SEM) to examine relationships between engagement and related variables. Kedia & Mishra (2023) and Yang et al. (2024) modeled engagement as a mediating construct between learning factors and outcomes. Hazzam & Wilkins (2023) found that lecturer leadership and technology use strongly predicted learning performance and student satisfaction. Zhang & Li (2024) combined SEM with fuzzy-set qualitative comparative analysis (FSQCA). Their findings showed that immersive experience and habit formation repeatedly appeared in high-engagement patterns. The absence of immersive experience was also strongly associated with low engagement.

Ecological Momentary Assessment Approach to Student Engagement

Vilhunen et al. (2025) used Ecological Momentary Assessment (EMA) to capture engagement in real time during learning activities. Students reported their interest, challenge, and skill levels during the learning process itself. EMA captures the moment-to-moment nature of engagement more effectively than retrospective surveys or behavioral logs. This approach reduces recall bias and helps identify which learning activities generate stronger engagement at specific moments.

Discussion

The findings of this review suggest that student engagement in digital learning is shaped less by technology itself and more by the conditions surrounding learning. Engagement emerged as a dynamic process influenced by learner psychology, instructional design, and the social learning environment (Eccles & Wang, 2012; Li et al., 2023). This review helps explain not only how engagement appears across digital contexts, but also why engagement sometimes fails to develop. The multidimensional structure of engagement proposed by Fredricks et al. (2004) remained consistently visible across the reviewed studies. Behavioral, cognitive, and emotional engagement appeared closely connected, while agentic engagement increasingly emerged as a distinct dimension (Bond, 2021; Reeve & Tseng, 2011). Importantly, emotional engagement appeared to play a foundational role. Students who felt psychologically unsafe, socially isolated, or emotionally disconnected were less likely to invest cognitive effort or maintain participation, even when learning materials were well designed (Alghamdi et al., 2024; Bamoallem & Altarteer, 2022).

Psychological factors such as self-efficacy, intrinsic motivation, and sense of belonging also influenced engagement strongly (Cho & Heron, 2015; Yang et al., 2024). However, these factors did not operate independently from learning design. The reviewed studies consistently showed that instructional structure could either strengthen or weaken students' psychological resources. When learning environments provided clear guidance, appropriate challenge, instructor presence, and structured interaction, students engaged more actively. In contrast, weak structure and low social support often reduced engagement, even among students with relatively high self-efficacy. These findings support the idea that engagement is not produced by motivation alone, but through the interaction between students and their learning environment.

Another important issue across the literature concerns how engagement is measured. Self-report surveys mainly capture perception, while behavioral analytics mainly capture visible activity (Azevedo, 2015; Henrie et al., 2015). Neither approach fully captures the cognitive depth or emotional quality of engagement. As a result, it remains difficult to determine which forms or levels of engagement are most important for meaningful learning outcomes. Most studies measured engagement at a single time point or over short interventions. This makes it difficult to understand how engagement develops over time. The role of agentic engagement also remains underexplored, especially in digital settings. Differences between secondary and university students were identified but not fully explained. The current review still lacks strong comparative evidence across these levels (Kahu & Nelson, 2018; Halverson & Graham, 2019). This gap was one of the main reasons for this review. While this study begins to address it, more focused comparative research is still needed.

These findings suggest that engagement should be designed, not assumed. Students are more likely to engage when they feel safe, connected, and appropriately challenged. Instructors play a key role in shaping this. Their responsiveness, feedback, and ability to create structured interaction directly influence engagement (Gopal et al., 2021; Stone, 2019). Technology should support interaction and participation, not just deliver content. At the institutional level, access to technology and support for instructional design are essential. Without these, engagement strategies may not work equally for all students.

Future studies should examine how student engagement develops over longer periods, such as full academic terms. Measurement approaches also need to go beyond behavioral indicators and better capture cognitive and emotional engagement. Mixed-method approaches that combine surveys, analytics, and real-time data are especially promising. More comparative research across educational levels is also needed to better understand how engagement differs between student groups.

CONCLUSIONS

This review provides a cross-level understanding of student engagement in digital learning by examining how engagement appears, which psychological factors shape it, and how it is measured across secondary school and university contexts. The findings show that meaningful engagement in digital learning is not determined by technology access alone. Instead, engagement is shaped by the psychological and social conditions surrounding the learning process. Student engagement consists of behavioral, cognitive, emotional, and agentic dimensions. These dimensions work together as an interconnected system. Emotional engagement appears to play an important role because it often becomes the foundation for deeper cognitive and behavioral engagement.

Social connection, instructor responsiveness, and self-efficacy emerged as the strongest factors supporting engagement. In contrast, social isolation, poor course design, and low psychological safety consistently appeared as major barriers across digital learning contexts. Current measurement approaches are still dominated by self-report questionnaires and

behavioral analytics. However, these methods often fail to capture the cognitive and emotional depth of engagement that is most closely related to meaningful learning experiences.

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AUTHOR CONTRIBUTION STATEMENT

ANQRA contributed to the conceptualization of the study, literature search, data extraction, thematic analysis, manuscript drafting, and final revision. MAA contributed to the methodological design, screening of selected studies, validation of extracted data, interpretation of findings, and critical review of the manuscript. HN contributed to the theoretical framing, synthesis of discussion, manuscript refinement, and final approval of the article. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

AI DISCLOSURE STATEMENT

The authors used artificial intelligence-based language assistance tools to support language refinement, grammar checking, and improvement of academic clarity during manuscript preparation. The use of AI was limited to editorial and language-enhancement purposes and did not replace the authors' intellectual contribution, conceptual development, data analysis, interpretation of findings, or scholarly judgment. All content generated or refined with AI assistance was reviewed, verified, and approved by the authors.

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