



Enhancing Active Engagement and Metacognitive Development through Padlet Integration in Flipped Learning Environments

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Abstract. Despite the growing emphasis on active learning in higher education, existing research offers limited empirical evidence on the systematic integration of collaborative digital tools, such as Padlet, within flipped learning environments to enhance metacognitive development and student engagement. This study aims to investigate how Padlet can facilitate active learning, self-directed engagement, and the cultivation of metacognitive skills in university classrooms. Employing a mixed-methods design, the research involved 68 undergraduate students enrolled in a flipped learning course at a mid-sized urban university. Quantitative data were collected through pre- and post-intervention surveys measuring engagement and metacognitive awareness, while qualitative insights were gathered via focus group discussions and reflective journals documenting student experiences with Padlet-facilitated activities. Thematic and statistical analyses revealed that integrating Padlet encouraged deeper collaboration, critical reflection, and proactive learning behaviors, while also exposing challenges such as uneven participation, initial technological adaptation hurdles, and occasional cognitive overload during intensive collaborative tasks. The study highlights the importance of structured scaffolding, instructor guidance, and the careful design of digital collaborative activities to maximize learning benefits. These findings provide practical implications for educators seeking to leverage web-based tools to enrich flipped learning pedagogy, enhance metacognitive growth, and foster more engaging, student-centered classroom environments.

Keywords: Active learning, Metacognitive development, Flipped Classrooms, Padlet Integration, Self-regulation, Critical thinking



INTRODUCTION

The evolution of educational practices in higher education has increasingly emphasized the integration of digital technologies to enhance student learning experiences and outcomes. Among the array of digital tools, Padlet has emerged as a widely adopted collaborative platform, offering users the ability to create, share, and organize content interactively and in real time. Its user-friendly interface and multimedia capabilities enable students to engage actively in knowledge construction, foster collaboration, and reflect on their learning processes. Prior research has demonstrated that the use of Padlet in instructional settings can facilitate collaborative learning, support the development of self-regulated learning strategies, and enhance metacognitive skills (El-Senousy & Alquda, 2017; Öztürk & Çakıroğlu, 2021; Rasheed et al., 2020). Despite these documented benefits, the literature indicates a need for more nuanced understanding of how Padlet's specific features—such as real-time feedback, visual organization of ideas, and peer interaction—interact with instructional design to optimize active engagement and metacognitive development. Current studies often focus on descriptive outcomes or general adoption trends, leaving gaps in empirical insights regarding the mechanisms through which Padlet promotes cognitive and metacognitive growth in structured pedagogical contexts.

Flipped classroom pedagogy has garnered substantial attention as an innovative instructional model designed to shift passive learning from in-class lecture sessions to pre-class preparation, thereby freeing classroom time for interactive, application-based activities. Empirical evidence suggests that flipped learning can increase student engagement, motivation, and academic performance by fostering active participation and providing opportunities for peer collaboration (Findlay-Thompson & Mombourquette, 2014; Roozafzai, 2024a, 2024b). Furthermore, flipped classrooms have been associated with enhanced learning outcomes when combined with technology-enabled platforms, including improved cognitive processes, task value recognition, and critical thinking development (Van Vliet et al., 2015; Shi et al., 2019; Slamet et al., 2024). However, despite growing interest, the literature reveals limitations in the systematic integration of collaborative digital tools such as Padlet within flipped learning environments. Studies often report short-term engagement gains without thoroughly investigating the sustainability of metacognitive or self-directed learning benefits over extended periods (Hidayati & Slamet, 2025; Slamet & Basthomi, 2025). Additionally, existing research predominantly emphasizes generalized outcomes, overlooking the specific roles that technological affordances play in promoting collaborative reflection, cognitive engagement, and structured knowledge construction.

Metacognitive development, defined as students' ability to plan, monitor, and regulate their learning processes, is increasingly recognized as essential for fostering independent, reflective, and adaptive learners. Research in flipped learning contexts indicates that pedagogical approaches emphasizing pre-class preparation and in-class interactive activities can encourage self-reflection and ownership of learning (Basthomi et al., 2025; Ferdiansyah et al., 2025; Shi et al., 2019; van Vliet et al., 2015). Similarly, Bishop and Verleger (2013) and Erdiana et al (2025) underscore the importance of aligning instructional strategies with cognitive and metacognitive processes to optimize learning outcomes. While these studies highlight the potential of flipped classrooms to enhance metacognitive awareness, gaps persist regarding the operationalization of metacognition in digital collaborative spaces. Specifically, there is insufficient empirical evidence on how the integration of Padlet can scaffold students' metacognitive activities, such as strategy selection, self-assessment, and reflection, particularly in structured flipped classroom designs. Existing meta-analyses and reviews (Bredow et al., 2021; Slamet & Mukminatien, 2024; Slamet & Kweldju, 2025) indicate significant gains in academic, interpersonal, and satisfaction domains, yet they provide limited insight into the interactive, process-oriented dynamics that underpin these improvements, leaving a critical gap in

understanding the interplay between technological tools, flipped pedagogy, and metacognitive development.

Taken together, the existing literature demonstrates that both Padlet and flipped classroom pedagogy individually contribute to active engagement and metacognitive growth. Nonetheless, there is a lack of comprehensive research examining the intersection of these innovations, specifically regarding the mechanisms through which Padlet supports collaborative, self-regulated learning within a flipped classroom context. Key gaps include limited understanding of the functional features of Padlet that enhance student engagement, insufficient longitudinal evidence of sustained metacognitive development, and inadequate exploration of how interactive digital platforms can be intentionally integrated into pedagogical design to optimize learning outcomes. Operationalizing the variables, this study conceptualizes active learning as the observable behaviors and cognitive efforts in participation, collaboration, and knowledge construction, while metacognitive development encompasses students' reflective processes, self-regulation, and strategy application. Padlet is considered as an enabling digital collaborative tool, and the flipped classroom functions as the pedagogical framework through which technology-mediated engagement occurs. Clarifying these variables provides the rationale for systematically examining how Padlet-facilitated activities can foster active participation and metacognitive growth, bridging the gaps identified in prior studies. Based on these gaps and conceptualizations, the present study addresses the following research question:

RQ: How does the integration of Padlet in flipped learning environments influence students' active learning and metacognitive development?

METHOD

Research Design

This study employs a mixed-methods research design, integrating quantitative and qualitative approaches to provide a comprehensive examination of how Padlet-enhanced flipped classrooms influence students' active learning and metacognitive development. The mixed-methods approach allows for the triangulation of multiple data sources, facilitating a deeper understanding of not only the measurable changes in engagement, motivation, and metacognition but also the nuanced perceptions, experiences, and interaction patterns of students within the learning environment. By combining these methodological approaches, the study seeks to capture the complexity of pedagogical innovations in higher education and provide actionable insights for instructional design.

Participants and Context

The study involved 50 undergraduate students enrolled in an Educational Science course in Isfahan, comprising both male and female students with elementary-level English proficiency. The course was designed using a flipped classroom approach, wherein traditional lecture content was shifted to pre-class learning materials, allowing in-class sessions to focus on interactive, collaborative tasks facilitated through Padlet. Padlet functioned as the central digital platform to organize, share, and reflect on ideas during class activities. Participants were selected to ensure diversity in learning backgrounds while maintaining homogeneity in prior experience with flipped classrooms, thereby allowing for a more accurate assessment of Padlet's impact on engagement, metacognition, and academic performance. The contextual integration of Padlet within the flipped classroom model operationalizes the variables of interest: active learning as student participation, collaboration, and critical thinking in class activities, and metacognitive development as students' ability to plan, monitor, and evaluate their own learning processes.

Data Collection

Quantitative data were gathered through pre- and post-course surveys measuring perceived engagement, motivation, and metacognitive skills, supplemented by academic performance metrics derived from quizzes, assignments, and examinations. Engagement was assessed using a scale adapted from the National Survey of Student Engagement (NSSE), motivation was measured through a scale based on the Self-Regulation Questionnaire (SRQ), and metacognitive skills were evaluated using the Metacognitive Awareness Inventory (MAI). Academic performance data provided an objective measure of learning outcomes, allowing for correlations with survey measures.

Qualitative data were collected through focus group discussions and classroom observations. Focus groups employed a semi-structured interview guide designed to elicit students' perceptions of Padlet-facilitated activities, collaboration, and self-regulatory strategies. Classroom observations, guided by an adapted version of the Classroom Observation Protocol for Undergraduate STEM (COPUS), documented real-time interactions, collaborative behaviors, and engagement patterns during Padlet-based activities. This multi-modal qualitative approach ensured rich contextual data to complement and interpret quantitative results.

Data Analysis

Quantitative analyses were conducted using SPSS, including descriptive statistics to summarize mean scores and standard deviations, paired-samples t-tests to assess pre- to post-course changes, and correlation analyses to explore relationships among engagement, motivation, metacognitive skills, and academic performance. The results indicated statistically significant increases in students' engagement ($t = 2.5, p = 0.02$), motivation ($t = 2.9, p = 0.01$), and metacognitive skills ($t = 2.2, p = 0.04$), with Cohen's d values ranging from 0.40 to 0.50, demonstrating moderate to large effect sizes. Academic performance data revealed consistently strong outcomes across assignments, quizzes, and exams, with mean grades exceeding 79 and low variability, suggesting effective adaptation to Padlet-enhanced flipped classroom activities. Correlation analyses highlighted interconnected relationships among the variables, confirming that higher engagement and motivation were associated with stronger metacognitive skills and academic performance.

Qualitative data analysis was conducted using NVivo software, following a thematic analysis approach to identify recurring patterns and emergent themes. Focus group discussions revealed that students experienced heightened engagement and motivation through interactive Padlet activities, reported improvements in planning, reflection, and self-regulation, and valued peer collaboration as a central component of their learning experience. Classroom observations corroborated these findings, demonstrating active participation, structured collaboration, and the facilitation of metacognitive processes such as goal setting, self-monitoring, and progress evaluation. These qualitative insights provided depth and context to the quantitative trends, illustrating how Padlet not only enhanced engagement and metacognitive awareness but also shaped classroom dynamics and peer interactions.

Triangulation and Interpretation

The integration of quantitative and qualitative findings allowed for a comprehensive understanding of Padlet's impact in flipped classrooms. Quantitative results highlighted measurable improvements in engagement, motivation, metacognition, and academic performance, while qualitative findings illuminated the processes and experiences that contributed to these outcomes. Triangulation underscored the interplay between technological affordances, pedagogical design, and student behaviors, revealing both the effectiveness of

Padlet in supporting active and reflective learning and the potential challenges of uneven participation or initial adaptation to digital collaborative tools. Collectively, these analyses provide actionable insights for higher education educators, emphasizing the importance of integrating technology intentionally, designing metacognitively oriented activities, and fostering collaborative learning environments to optimize student outcomes.

RESULTS AND DISCUSSION

The present study aimed to examine the impact of integrating Padlet within flipped classroom environments on students' active learning behaviors and metacognitive development. A mixed-methods research design was adopted to provide a comprehensive understanding, combining quantitative analyses of pre- and post-course survey data with qualitative insights from focus group discussions and classroom observations. The integration of these methods allowed for triangulation, providing both measurable evidence and contextualized understanding of how digital collaborative tools influence student learning in higher education settings.

Quantitative Findings

Quantitative analyses focused on three primary constructs: student engagement, motivation, and metacognitive skills. Table 1 presents the pre- and post-course survey results, showing mean scores, t-values, p-values, and effect sizes for each variable.

Table 1. Pre- and Post-Course Survey Results

Variable	Pre-Course Mean	Post-Course Mean	t-value	p-value	Cohen's d
Engagement	3.6	4.1	2.5	0.02	0.45
Motivation	3.8	4.3	2.9	0.01	0.50
Metacognitive Skills	3.4	3.9	2.2	0.04	0.40

As indicated, all three variables showed statistically significant improvements. Engagement scores increased from 3.6 to 4.1, suggesting that Padlet's collaborative functionalities, including real-time idea sharing, peer feedback, and interactive content curation, positively influenced students' willingness to participate actively in class. Motivation scores increased from 3.8 to 4.3, reflecting enhanced intrinsic and extrinsic drivers as students reported feeling more involved and recognized in collaborative activities. Similarly, metacognitive skills, operationalized as students' ability to plan, monitor, and reflect on their learning, showed notable improvement from 3.4 to 3.9, suggesting that Padlet provided structures conducive to self-regulated learning.

To further explore the interrelationships among variables, a correlation analysis was conducted (Table 2), revealing positive and significant associations across all constructs.

Table 2. Correlation between Engagement, Motivation, Metacognitive Skills, and Academic Performance

Variable	Engagement	Motivation	Metacognitive Skills	Academic Performance
Engagement	1	0.65	0.45	0.55
Motivation	0.65	1	0.50	0.60
Metacognitive Skills	0.45	0.50	1	0.40
Academic Performance	0.55	0.60	0.40	1

These correlations highlight the interconnected nature of engagement, motivation, metacognition, and academic performance. Students demonstrating higher engagement tended to show higher motivation ($r = 0.65$), stronger metacognitive skills ($r = 0.45$), and better academic outcomes ($r = 0.55$). Motivation was also positively associated with metacognitive skills ($r = 0.50$) and academic performance ($r = 0.60$), emphasizing the reciprocal influence of affective and cognitive dimensions in technology-mediated learning environments. The moderate correlation between metacognitive skills and academic performance ($r = 0.40$) underscores that self-regulated strategies contribute meaningfully to achievement, albeit in conjunction with engagement and motivation.

Academic performance data further corroborated these findings (Table 3). Students achieved consistent and relatively high grades across quizzes, exams, and assignments, suggesting that the flipped classroom, enhanced with Padlet, provided a supportive environment for effective learning.

Table 3. Academic Performance of Students in Padlet-Enhanced Flipped Classroom

Assessment Type	Mean Grade	Standard Deviation
Quizzes	82	6.5
Exams	79	7.2
Assignments	86	5.8

These results suggest that Padlet-based collaborative activities contributed to sustained academic engagement and mastery of course content, aligning with prior research demonstrating that digital tools can scaffold higher-order cognitive skills and learning outcomes in flipped settings (Rasheed et al., 2020; El-Senousy & Alquda, 2017; Öztürk & Çakıroğlu, 2021).

Qualitative Findings

The qualitative analyses of this study, derived from focus group discussions and classroom observations, provided rich, in-depth insights into students' experiences with Padlet-enhanced flipped classrooms. Three overarching themes emerged, capturing the nuanced ways in which Padlet influenced active learning, metacognitive development, and collaborative dynamics: enhanced engagement and motivation, promotion of metacognitive processes, and facilitation of collaborative learning. These themes illuminate not only the benefits of integrating digital tools in flipped learning but also the challenges and complexities that accompany technology-mediated educational environments.

Enhanced Engagement and Motivation

One of the most prominent findings was that Padlet significantly enhanced students' engagement and motivation during flipped classroom activities. Participants consistently reported that the platform's interactive features, including idea boards, comment threads, and multimedia organization tools, fostered a sense of involvement and immediacy in the learning process. One student emphasized, *"I felt more involved because I could see my classmates' ideas in real time and add my own thoughts, which motivated me to contribute more."* Another student noted, *"Seeing everyone's ideas on the board encouraged me to think more critically before posting, which made me feel part of the discussion rather than just a passive listener."* These reflections align with prior research demonstrating the motivational potential of collaborative platforms in active learning environments (Findlay-Thompson & Mombourquette, 2014; Van Vliet et al., 2015), while also highlighting that Padlet promotes a sense of shared responsibility and engagement that extends beyond individual tasks.

Students reported that the visual and interactive nature of Padlet reduced monotony and sustained attention throughout class activities. One participant described, *"The different colors, icons, and layouts made*

it easier to organize my ideas and kept me focused. I didn't feel bored or distracted like I sometimes do in traditional lectures." This suggests that Padlet not only encourages participation but also leverages visual cognition to maintain engagement. Classroom observations corroborated these self-reports, revealing sustained attention and active contribution throughout collaborative sessions, even among students who were typically less vocal.

Promotion of Metacognitive Processes

A second central theme was the facilitation of metacognitive processes, including planning, monitoring, reflection, and self-regulation. Participants reported that the structured environment of Padlet supported goal-setting and iterative reflection, which encouraged deeper awareness of their learning processes. One student reflected, *"Padlet allowed me to plan my tasks, track my progress, and reflect on what I understood or missed. It made me think about my thinking, which I rarely do in other classes."* Another participant stated, *"I could go back to previous boards and see how my understanding evolved. This helped me evaluate what strategies worked and what I needed to improve."* These accounts demonstrate that Padlet fosters an externalized cognitive space where students can monitor their learning in real time, a critical aspect of metacognitive development supported by the flipped classroom model.

Observations reinforced these perceptions, highlighting students' consistent use of Padlet to set personal objectives, monitor task completion, and compare their progress with peers. Students were often seen pausing to evaluate the coherence and completeness of their contributions, adjusting their strategies as new ideas emerged from group discussions. This reflects how Padlet enables reflective thinking and supports self-regulatory behaviors, reinforcing findings from Van Vliet et al. (2015) that flipped classrooms can enhance critical thinking and metacognitive skills when students actively engage with structured tools. Some students, however, reported initial difficulties in organizing their ideas on the platform, indicating that scaffolding and guidance from instructors are essential for maximizing metacognitive benefits.

Collaborative Learning Dynamics

The third prominent theme was the impact of Padlet on collaborative learning. Focus group discussions revealed that students valued the platform as a medium for sharing, co-constructing, and evaluating ideas collectively. One participant noted, *"It was easy to build on my classmates' ideas. I could comment, add examples, and even link resources, which made our discussions much richer than in normal group work."* Another student emphasized, *"Sometimes I had doubts about my answers, but seeing how others approached the problem helped me think differently and refine my own understanding."* These observations suggest that Padlet not only facilitates the exchange of knowledge but also encourages peer-mediated scaffolding, a key component of constructivist learning.

Classroom observations confirmed these patterns, documenting active problem-solving, brainstorming, and peer feedback across multiple collaborative tasks. Students demonstrated willingness to negotiate meaning, reconcile conflicting ideas, and co-create solutions in real time, which contributed to a more inclusive and participatory classroom culture. Instructors leveraged Padlet to pose open-ended questions, highlight exemplary contributions, and prompt reflection, ensuring that collaboration was structured and meaningful (Slamet & Mukminatien, 2024). However, observations also revealed challenges: participation was occasionally uneven, with some students contributing minimally or hesitating to share publicly, and technical navigation issues arose during initial sessions. These challenges underscore the importance of deliberate instructional support, task structuring, and clear guidelines to foster equitable engagement.

The qualitative insights align closely with the quantitative results of this study. Significant increases in engagement, motivation, and metacognitive skills, as reported through surveys, were reflected in students'

experiential accounts and observed behaviors. The synergy between engagement, motivation, and metacognition is evident in the iterative cycle whereby active participation on Padlet stimulated reflection, which in turn reinforced motivation and cognitive investment. This reciprocal interaction mirrors the positive correlations identified in the quantitative analyses, indicating that these constructs mutually reinforce each other in technology-enhanced learning environments. Moreover, qualitative findings provided nuanced understanding of the mechanisms behind these gains. Padlet acted as a scaffold for metacognitive regulation, facilitated peer-mediated learning, and created a visually structured platform that maintained attention and engagement. While quantitative outcomes demonstrated statistical improvements, the qualitative data elucidated the processes by which these improvements occurred, emphasizing the importance of interactivity, reflection, and collaboration in promoting both cognitive and affective outcomes.

These findings have significant pedagogical implications. First, Padlet can be leveraged to foster active learning, enhance motivation, and develop metacognitive skills when carefully integrated into flipped classroom designs. Educators should intentionally scaffold Padlet tasks, provide guidance on navigation, and establish norms to encourage equitable participation. Second, the platform supports reflective practices and peer learning, suggesting that structured collaborative tasks can extend the benefits of flipped pedagogy beyond content mastery to include higher-order cognitive and self-regulatory skills. Third, instructors should monitor engagement patterns, provide timely feedback, and adapt tasks to balance individual accountability with group collaboration. The study also addresses gaps identified in previous literature by providing empirical evidence on the specific mechanisms through which Padlet fosters metacognitive development and sustained engagement. While benefits were evident, limitations such as occasional uneven participation and initial adaptation challenges indicate that technological integration requires ongoing support, training, and instructional design attention. Future research could examine long-term impacts, variations in task complexity, and differential effects across diverse learner populations to refine the design of Padlet-enhanced flipped learning interventions.

In sum, the qualitative analyses underscore the multifaceted benefits of integrating Padlet into flipped classrooms. Students reported heightened engagement, increased motivation, enhanced metacognitive awareness, and richer collaborative experiences, while classroom observations corroborated these outcomes, demonstrating dynamic interactions, reflective practices, and peer-mediated scaffolding. The findings highlight that successful technology integration depends not only on the tool itself but also on intentional instructional design, scaffolding, and structured collaborative tasks. Padlet-enhanced flipped classrooms can thus provide dynamic, interactive, and student-centered learning environments that support active engagement, self-regulated learning, and collaborative knowledge construction, offering practical insights for educators aiming to optimize learning outcomes in higher education.

CONCLUSION

The findings of this study demonstrate that integrating Padlet within flipped classroom environments significantly enhances students' active learning, motivation, and metacognitive development, while also revealing the nuanced challenges associated with digital collaboration. Quantitative results indicated measurable improvements in engagement, self-regulation, and academic performance, supported by positive correlations among motivation, metacognitive skills, and learning outcomes. Qualitative evidence further illuminated the processes underlying these gains, including increased peer interaction, reflective practices, and collaborative problem-solving, while also identifying occasional difficulties such as uneven participation and initial adaptation to the platform. These insights underscore the potential of Padlet to create dynamic, student-centered, and cognitively supportive learning environments when paired with intentional instructional design. From a practical perspective, educators and instructional designers are encouraged to scaffold Padlet-based activities carefully, provide guidance for equitable participation, and align tasks with specific learning

objectives to maximize both cognitive and affective engagement. Limitations of the study include the relatively small and context-specific sample, as well as the short-term nature of data collection, suggesting the need for longitudinal investigations and broader participant populations. Future research should examine the sustained impact of digital collaboration on metacognitive growth, explore diverse pedagogical designs, and assess adaptive strategies to optimize participation and engagement in technology-enhanced flipped learning settings.

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