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A Literature Review on the Roles of Digital Literacy, Self-Regulated Learning, and Peer Support in Enhancing Students' Academic Achievement in the Era of Hybrid Learning

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Abstract: Hybrid learning research emphasizes technology, cognition, and social support, yet an integrated framework explaining their combined effect on academic performance is limited. This study examines how digital literacy (DL), self-regulated learning (SRL), and peer support (PS) interact to shape student achievement in hybrid environments. Guided by the research question on the relationships among DL, SRL, PS, and academic outcomes, a narrative literature review analyzed studies from 2017–2025 in Scopus, Google Scholar, and Sinta journals, focusing on higher education and covering technological, cognitive, and social dimensions. Findings show that DL provides a cognitive foundation for accessing, filtering, and integrating information, enhancing SRL processes such as planning, monitoring, and self-evaluation. Peer support strengthens motivation, collaboration, and resilience, and when combined with DL, further amplifies SRL, which mediates their impact on academic performance. The study contributes a novel framework conceptualizing these interdependent mechanisms as a mutually reinforcing hybrid learning ecosystem. Practically, institutions can foster academic success by promoting reflective digital literacy, embedding SRL-supportive practices, and structuring peer support for cognitive and emotional scaffolding.

Keywords: Academic Performance, Digital Literacy, Higher Education, Peer Support, Self-Regulated Learning

INTRODUCTION

Higher education has transformed rapidly in recent years, driven primarily by accelerated digitalization that reshapes how students access information, interact with instructors, and construct knowledge. This shift has propelled hybrid learning to emerge as a dominant model within contemporary education. Raes et al. (2020) highlight that hybrid learning developed as a response to increasing demands for flexibility, although challenges remain in achieving

seamless pedagogical integration. Gudoniene et al. (2025) further emphasize that hybrid learning constitutes a complex ecosystem requiring technological readiness, digital competence, and well-designed instructional frameworks. The success of hybrid learning ultimately depends on how institutions and students manage the simultaneous interplay between online and offline environments.

This shift has also redefined the meaning of academic performance. Hendrowati et al. (2025) argue that hybrid learning enriches learning experiences by combining physical and digital activities, although its effectiveness is mediated by the level of student engagement. Mulenga and Shilongo (2025) find that this innovation introduces challenges related to participation consistency and students' ability to navigate digital tools. A meta-analysis by Kazu and Yalçın (2022) indicates that hybrid learning can enhance academic achievement when supported by well-designed instructional strategies.

Structural changes in learning environments require students to possess competencies suited to increasingly digitalized educational ecosystems. One essential competency is digital literacy, which, according to Spante et al. (2018), includes the ability to access, understand, evaluate, and effectively use digital information. Spires et al. (2018) underscore the importance of critical participation in digital ecosystems, while Pangrazio et al. (2020) add that digital literacy also encompasses interpreting and applying digital content across cultural and linguistic contexts. Müller and Mildemberger (2021) show that the effectiveness of hybrid online learning is strongly influenced by students' ability to use digital platforms, and Ashraf et al. (2021) note that disparities in digital competence still challenge blended learning implementation. These findings confirm that digital literacy serves as a foundational determinant of student success in hybrid learning environments.

In addition to digital skills, self-regulated learning (SRL) plays a crucial role in hybrid settings that combine online and face-to-face activities. Zimmerman (1990) conceptualizes SRL as a process through which students proactively plan, monitor, and evaluate their learning activities to achieve academic goals. Panadero (2017) emphasizes that SRL encompasses integrated cognitive, motivational, and metacognitive strategies that enable students to adapt to varying academic demands. Rasheed et al. (2020) highlight that the online component of hybrid learning requires students to regulate their time, sustain attention, and maintain self-motivation in the absence of direct supervision. Furthermore, Theobald's (2021) meta-analysis demonstrates that SRL significantly enhances academic performance and the development of effective learning strategies across diverse contexts. Thus, SRL constitutes the second essential foundation, alongside digital literacy, for student success within the complexity and flexibility of hybrid learning.

Beyond individual factors, peer support also contributes to academic success in hybrid learning systems. Yuliawati et al. (2025) indicate that peer support includes emotional, instrumental, and social assistance exchanged among students to strengthen connectedness and resilience when facing academic challenges. Mead and MacNeil's (2006) conceptualization emphasizes the unique nature of peer support as an interactional process that facilitates problem-solving, motivation, and collaborative learning. Park et al. (2019) demonstrate that success in hybrid courses is shaped not only by individual capabilities but also by the quality of social interaction and peer collaboration. This aligns with Bailey (2020), who finds that student satisfaction and success improve when supportive social environments are available, especially when students encounter technical or psychological challenges in online activities. Accordingly, peer support emerges as a critical complementary foundation, together with digital literacy and self-regulated learning, for enabling students to navigate the complexities of hybrid learning.

Studies on digital literacy, self-regulated learning (SRL), and peer support consistently demonstrate that these three factors substantially influence students' academic success,

although empirical work that integrates them simultaneously within hybrid learning settings remains scarce. Digital literacy constitutes a foundational competency that conditions students' readiness to navigate learning technologies and platforms, thereby enabling smoother adaptation and supporting self-regulatory capacities in online environments (Holm, 2024; Ardhiani et al., 2023; Chen, 2025; Getenet et al., 2024). SRL, in turn, is widely recognized as a central predictor of learning effectiveness, equipping students with the ability to plan, monitor, and evaluate their learning processes independently (Xiao et al., 2019; Luo & Zhou, 2024; Caixia et al., 2025; Martínez-López et al., 2023). Complementing these individual capabilities, peer support contributes to heightened motivation, engagement, and academic competence through socially embedded forms of interaction that reinforce learning persistence (Altermatt, 2019; Worley et al., 2023; Yuliawati et al., 2025; Park et al., 2019; Bailey, 2020; Mead & MacNeil, 2006). Collectively, the literature affirms the importance of each factor in shaping learning processes within hybrid instructional environments and in supporting students' academic achievement.

Despite these insights, the existing body of research has yet to articulate an integrative framework that captures the technological, cognitive, and social dimensions underlying variations in academic performance. This absence suggests a need for further inquiry that examines how digital literacy, SRL, and peer support jointly influence student outcomes, thereby offering a more consolidated theoretical perspective.

Responding to this gap, the present study is guided by the following research question: How do digital literacy, SRL, and peer support relate to students' academic achievement in hybrid learning environments? The study aims to identify empirical patterns among these variables, synthesize the theoretical contributions each factor offers, and conceptualize their interrelationships to develop a more comprehensive understanding of the mechanisms that underpin effective hybrid learning.

METHOD

This study adopts a narrative literature review to examine the links between digital literacy, self-regulated learning (SRL), peer support, and academic achievement in hybrid learning. Literature was sourced from Scopus, Google Scholar, and Sinta journals (2017–2025) using Boolean-based keywords related to digital literacy, hybrid learning, SRL, peer support, and student achievement. We included higher-education studies using empirical, systematic review, or meta-analytic designs, while excluding non-HE, non-peer-reviewed, and technology-only studies lacking behavioral dimensions. Article selection followed systematic review protocols, from identification to full-text assessment (Hadi & Afandi, 2021; Matos et al., 2023). Thematic analysis mapped technological (DL), cognitive (SRL), and social (peer support) patterns, evaluated their contributions to academic achievement, and identified research gaps in hybrid learning.

RESULTS AND DISCUSSION

To identify the empirical patterns that characterize the relationship between digital literacy, self-regulated learning, peer support, and students' academic performance, the following table presents a systematic and structured mapping of studies that met the established inclusion criteria. Each article is categorized according to its research context, the specific dimensions of the three variables examined, the methodological approaches employed, and the principal findings related to academic achievement. This mapping illustrates both recurring consistencies and notable variations across the literature in how these variables, including technological competencies and evaluative skills within digital literacy, self-monitoring and strategic learning behaviors within SRL, and affective or instrumental support within peer interactions, collectively facilitate learning processes and shape academic outcomes. The

“Insight for Current Study” column synthesizes each study's distinct contributions, identifies emerging empirical patterns, and highlights areas where evidence remains limited, establishing a solid foundation for the subsequent analytical synthesis.

Table 1. Literature Mapping on Digital Literacy

No.	Author & Year	Focus of Study	Research Method	Key Findings	Insight for Current Study
1	Abbas et al. (2019)	To examine the effect of basic ICT competence on students' academic performance in higher education.	Quantitative descriptive survey	Basic ICT competence enhances students' performance, especially in technology-mediated courses where digital tools are integral to academic tasks. Students with stronger ICT foundations show better task execution, improved understanding of digital materials, and greater efficiency in learning activities.	Establishes the baseline importance of fundamental digital literacy skills. Critical for understanding the foundational layer of digital competence before analyzing higher-order skills relevant in hybrid learning settings.
2	Ahmed & Roche (2021)	To analyze the relationship between digital literacy and academic success among EMI undergraduate students.	Quantitative correlational	Digital literacy predicts academic success by enhancing comprehension of digital content and effective use of academic technologies, with fluent digital navigation boosting performance	Confirms digital literacy as a direct predictor of academic achievement, supporting its role as an independent variable in hybrid learning
3	Akhyar et al. (2021)	To investigate how operational and evaluative ICT skills contribute to science learning outcomes during online learning.	Quantitative survey	Students' digital literacy supports improved science learning outcomes through effective use of learning management systems (LMS), better access to digital materials, and improved monitoring of learning tasks.	Demonstrates DL relevance across education levels. Reinforces that digital literacy facilitates content access and learning process regulation, important for linking DL to SRL in the review
4	Naz et al. (2022)	To assess the impact of digital literacy on academic performance among university students in Pakistan.	Quantitative survey	Digital literacy boosts academic performance by improving students' technological readiness and confidence, with psychological readiness, digital confidence, and perceived ease of use mediating the DL–performance link.	Provides evidence of psychological mechanisms linking DL to performance, aligning with SRL constructs and suggesting potential DL–SRL interactions in hybrid learning.
5	Latip et al. (2022)	To determine how digital literacy influences	Quasi-experimental	Students with higher digital literacy achieve better chemistry outcomes by effectively	Reinforces DL effects beyond general academic tasks, strengthening the

		learning outcomes in chemistry education.		accessing, evaluating, and interpreting online STEM resources.	cross-disciplinary generalizability of DL in the proposed conceptual model.
6	Sari (2022)	To analyze the relationship between digital literacy, self-directed learning readiness, and academic performance.	Quantitative survey	Digital literacy affects academic performance directly and indirectly via self-directed learning, enabling students to autonomously organize, search, and manage digital information	Provides strong empirical linkage between DL and SRL, essential for integrating the three core variables (DL–SRL–Peer Support) in the review framework.
7	Udeogalanya (2022)	To explore how digital adaptability affects academic success in post-pandemic higher education.	Mixed-method	Digital adaptability, an advanced dimension of digital literacy, emerged as a determinant of academic success in the transition from online to hybrid systems. Students who adapt quickly are resilient and achieve higher performance	Shows that DL must be viewed dynamically, adaptive DL is critical for hybrid learning. Supports the argument that DL is not only technical but also behavioral.
8	Mokhtari (2023)	To conceptually describe digital literacy's role in enhancing critical evaluation and academic task quality.	Narrative review	Digital literacy enhances critical reasoning, evaluative judgment, and advanced information processing, reflecting its multidimensional role beyond technical skills	Extends digital literacy into higher-order cognitive skills, integrating evaluative dimensions in this study
9	Jaya & Sucipto (2023)	To examine the effect of digital literacy on academic performance mediated by self-efficacy and engagement in hybrid learning.	Quantitative regression	Digital literacy positively influences academic achievement through increased academic self-efficacy and learning engagement. Higher DL enables students to participate more actively, manage tasks, and sustain motivation.	Highly relevant to hybrid learning. Provides empirical support for DL's interplay with SRL and peer engagement, aligns directly with the review's central variables.
10	Pala & Başbüyük (2023)	To evaluate whether digital literacy, motivation, and self-control jointly predict academic achievement in science–technology–society learning.	SEM	DL significantly predicts achievement, while its effect is amplified by motivation and self-control. The interaction of cognitive and psychological factors strengthens academic outcomes.	Suggests DL interacts with psychosocial variables. Relevant for positioning DL alongside SRL and peer support within a multi-layered academic achievement model.

11	Salimi et al. (2025)	To investigate how digital literacy influences knowledge sharing and academic performance in online environments.	SEM	Digital literacy contributes to academic performance indirectly by promoting knowledge-sharing behavior. Students with strong DL collaborate more actively, exchange resources, and leverage digital platforms to enhance peer learning.	Indicates indirect, socially mediated pathways, reinforcing the importance of peer support as a mediating or moderating factor in DL–achievement relationships within hybrid learning.
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The review of eleven empirical and conceptual studies demonstrates a clear pattern showing that students’ mastery of digital competencies plays a central role in shaping academic achievement across learning modalities. Early studies, such as Abbas et al. (2019), emphasize that fundamental ICT skills form the baseline enabling students to participate effectively in technology-mediated coursework. As the literature advances, the focus expands from operational abilities to higher-order competencies. For instance, Ahmed and Roche (2021) and Akhyar et al. (2021) highlight students’ ability to navigate digital learning systems and manage digital resources as pivotal for sustaining performance in increasingly digitalized academic environments.

Subsequent studies in more diverse contexts extend this perspective by revealing cognitive and behavioral dimensions of digital literacy. Latip et al. (2022) and Sari (2022) show that the capacity to search, evaluate, and apply digital information is closely tied to students’ autonomy and readiness for self-directed learning. Naz et al. (2022) further demonstrate that confidence in digital engagement and psychological readiness amplify the academic benefits of digital literacy, suggesting that its effect is partly mediated through motivational and self-regulatory factors. This evolving pattern culminates in broader conceptualizations, as observed in Mokhtari (2023), where digital literacy is framed as encompassing critical reasoning, evaluative judgment, and sophisticated information management essential for high-quality academic performance.

The literature also shows that digital literacy supports not only individual learning but also social and collaborative processes. Udeogalanya (2022) points to adaptability, an advanced dimension of digital literacy, as a critical factor in helping students navigate post-pandemic hybrid ecosystems. Meanwhile, Jaya and Sucipto (2023) and Pala and Başbüyük (2023) demonstrate that digital literacy strengthens engagement, self-control, and motivation, which collectively reinforce academic outcomes in hybrid learning settings. Salimi et al. (2025) further underscore the social dimension, reporting that students with strong digital literacy are more likely to engage in resource sharing, peer support, and collaborative knowledge exchange, ultimately enhancing academic performance.

Table 2. Literature Mapping – Self-Regulated Learning (SRL)

No.	Author(s) & Year	Purpose / Focus of Study	Research Method	Key Findings	Insight for Current Study
1	Alotaibi et al. (2017)	To examine how SRL components, goal setting, monitoring, and evaluation, relate to	Quantitative correlational	SRL was strongly associated with academic achievement; students with higher regulatory skills demonstrated better autonomy, persistence, and ability to manage	Positions SRL as a key predictor of academic performance in traditional contexts, establishing a baseline before digital or hybrid transitions

		academic achievement in community college students.		academic tasks effectively.	
2	Anthonyysamy et al. (2021)	To explore SRL strategies that support effective participation in digital learning environments.	Quantitative survey	Metacognitive strategies (planning, monitoring, self-evaluation) emerged as the strongest determinants of persistence and learning engagement in online learning contexts.	Reinforces SRL as central in digital/hybrid contexts, stressing its role as a core mechanism in analyses of digital literacy and peer support.
3	Mirmoadi & Satwika (2022)	To analyze the relationship between digital literacy and SRL among Indonesian university students.	Quantitative correlational	Digital literacy enhances SRL maturity by enabling students to filter, select, and process digital information, improving focus, task management, and learning autonomy.	Provides empirical justification for modeling digital literacy as an antecedent of SRL within the hybrid learning framework.
4	Martin et al. (2022)	To investigate the interplay among SRL, motivational beliefs, grit, and academic achievement.	Quantitative SEM	SRL mediated the relationship between motivation, grit, and academic performance; metacognitive strategies were the most influential SRL dimension.	Emphasizes SRL's mediating role between cognitive–motivational traits and performance, reinforcing its central role in the conceptual model
5	Ballouk et al. (2022)	To review SRL patterns in blended learning among medical students.	Systematic scoping review	SRL improved with flexible learning and timely feedback, though online components challenged students' discipline and self-monitoring.	Provides insights for hybrid learning, showing SRL is most effective when instructional design and peer feedback are integrated
6	Elesio (2023)	To assess the influence of SRL strategies on college students' academic performance.	Quantitative regression	Time management, planning, and self-monitoring skills significantly predicted GPA and task completion quality, demonstrating SRL's direct role in performance.	Strengthens evidence that concrete SRL indicators (planning, monitoring) directly shape academic outcomes, validating SRL as a measurable independent variable in hybrid learning.
7	Amiruddin et al. (2023)	To test how the cybergogy-based instructional model enhances SRL.	Structural Equation Modeling	Interactive digital features, learner autonomy, and reflective activities significantly enhanced SRL development, showing that SRL grows through pedagogical design innovations.	Demonstrates that SRL is not static but can be intentionally strengthened through instructional design, relevant for developing hybrid learning strategies.

8	Prasaja & Octoria (2025)	To evaluate the combined effect of SRL and digital literacy on academic achievement.	Quantitative survey	Both SRL and digital literacy significantly predicted academic achievement; SRL contributed the strongest effect, indicating its dominant role in directing learning behaviors.	Confirms the theoretical integration between SRL and digital literacy, supporting their combined use in the hybrid learning performance model.
9	Faza & Lestari (2025)	To map global SRL strategies and technological supports in the digital age.	Systematic Literature Review	Identified four clusters of SRL (cognitive, metacognitive, motivational, and technological support); digital tools were found to enhance SRL strategy execution and monitoring.	Strengthens the conceptualization of SRL as a multidimensional construct that evolves alongside technological advancement, essential for hybrid learning theory.

A review of the nine selected articles demonstrates that self-regulated learning (SRL) consistently functions as a core cognitive and metacognitive mechanism that enhances academic performance across diverse learning contexts. Early evidence by Alotaibi et al. (2017) underscores that the ability to set goals, monitor learning progress, and evaluate outcomes serves as a primary determinant of student success in conventional classroom settings, establishing an essential foundation for understanding SRL prior to examining its role in digital environments. Within technology-mediated learning systems, Anthonysamy et al. (2021) further reveal that metacognitive strategies such as planning and self-monitoring are critical for sustaining continuous engagement, indicating that the effectiveness of digital learning is strongly shaped by the quality of students' self-regulation.

The relationship between digital literacy and SRL is reinforced by Mirmoadi and Satwika (2022), who find that competencies in managing digital information contribute to the maturity of SRL, particularly in areas related to maintaining focus, managing tasks, and fostering learning autonomy. The mediating function of SRL between internal motivation and academic performance is reaffirmed by Martin et al. (2022), showing that SRL channels the influence of motivation and grit into improved learning outcomes. In blended learning environments, Ballouk et al. (2022) demonstrate that flexible instructional design and timely feedback can strengthen SRL, although some students continue to experience challenges in maintaining discipline and consistency in monitoring their online learning activities.

Empirical confirmation that SRL strategies directly enhance academic performance is provided by Elesio (2023), who identifies time management and progress monitoring as significant predictors of academic grades and task completion quality. From a pedagogical perspective, Amiruddin et al. (2023) show that cybergogy-based instructional models enhance self-regulatory capabilities through interactive features and digital reflective activities. Further, Prasaja and Octoria (2025) confirm that SRL exerts a stronger influence on academic achievement than digital literacy, positioning it as the most critical variable in determining performance within hybrid learning systems. At a broader conceptual level, Faza and Lestari (2025) map global SRL clusters and highlight that technological support increasingly enriches SRL strategies, broadening the ways in which students organize and regulate their learning processes.

Table 3. Literature Mapping – Peer Support

No.	Author(s) & Year	Focus of Study	Research Method	Key Findings	Insight for Current Study
1	Russell et al. (2017)	To explore strategies for embedding peer support as a core learning skill within higher education institutions.	Qualitative evaluation in university learning environments	The study found that structured peer-support programs fostered collaborative problem-solving, improved help-seeking behaviors, and strengthened students' academic confidence.	Offers early evidence that structured peer-support systems improve student learning behaviors, supporting the framing of peer support as a pedagogical mechanism in hybrid learning.
2	Abbasi et al. (2019)	To examine the relationship between teacher and peer support with academic engagement, mediated by academic competence.	Quantitative survey among secondary school students	Peer support positively influenced academic engagement by strengthening students' sense of competence, showing that supportive peer interactions contribute to psychological readiness for learning.	Shows that peer support works through competence-building pathways, clarifying how supportive interactions enhance engagement in hybrid learning contexts.
3	Double et al. (2020)	To evaluate the effect of peer assessment on academic performance through meta-analysis of controlled studies.	Meta-analysis across multiple education levels	Peer assessment consistently improved academic performance by enhancing feedback quality, encouraging evaluative thinking, and promoting deeper cognitive processing.	Reinforces the cognitive and feedback-based dimension of peer support, demonstrating that peer involvement improves learning through reflective and evaluative mechanisms.
4	Maccabe & Fonseca (2021)	To analyze peer-to-peer support in engineering education and identify moments of transformative learning.	Qualitative case study in engineering programs	Peer interaction facilitated critical “lightbulb” learning moments, enabling conceptual breakthroughs, emotional reassurance, and shared problem-solving.	Highlights that PS not only assists understanding but also triggers deeper learning insights, important for hybrid settings that rely on collaborative digital tools.
5	Gunawan & Huwae (2022)	To test the effect of peer social support on academic resilience among students from disadvantaged (3T) regions.	Quantitative survey	Emotional and academic peer support significantly strengthened academic resilience, particularly for vulnerable student groups facing structural challenges.	Shows peer support as an adaptive resource that strengthens persistence and coping, especially in hybrid learning where self-discipline is crucial.
6	Marley & Wilcox (2022)	To examine how peer and family support	Quantitative survey with first-year	Peer support notably improved intrinsic motivation and early	Suggests that peer support plays a critical role during academic

		predict motivation and academic achievement among first-year university students.	undergraduate students	academic performance, aiding students' transition into higher education.	adjustment stages, aligning with hybrid learning where students must navigate new digital-academic norms.
7	Parmar et al. (2025)	To investigate how peer support enhances engagement and learning outcomes among postgraduate students in health sciences.	Qualitative thematic analysis	Academic, collaborative, and emotional support strengthened confidence, encouraged active participation, and improved conceptual understanding through collegial exchanges.	Confirms the multidimensional nature of peer support, academic, emotional, and collaborative, which must be integrated when conceptualizing peer support in hybrid environments.
8	Zhu et al. (2025)	To explain how perceived peer support influences academic adjustment through academic hope and professional identity.	Quantitative study with vocational college students	Peer support exerted an indirect yet significant effect on academic adjustment through the sequential mediation of academic hope and professional identity.	Highlights that peer support functions via layered psychological mechanisms, reinforcing the need to consider mediators when examining academic outcomes in hybrid systems.
9	Yang & Xiang (2025)	To explore the effect of peer support on academic engagement using a moderated mediation model.	Quantitative study with university students	Peer support enhanced academic engagement through psychological mediators, and the strength of these pathways depended on contextual moderating factors.	Demonstrates that peer support effects are conditional and non-linear, offering theoretical relevance for hybrid learning where context and digital environment shape peer interactions.

The reviewed literature demonstrates that peer support consistently emerges as an interpersonal resource that strengthens students' cognitive, motivational, and socio-emotional processes across diverse educational settings. Early work by Russell et al. (2017) indicates that when peer-support practices are intentionally embedded into higher education curricula, learners develop stronger collaborative habits, greater academic confidence, and more active help-seeking behaviours. These foundational insights reveal that peer interaction is not merely an auxiliary component but a core learning skill that shapes students' engagement patterns. Subsequent studies reinforce this trajectory. For instance, Abbasi et al. (2019) show that supportive peer dynamics cultivate students' sense of academic competence, which in turn fuels their willingness to participate and persist in academic tasks. Meanwhile, meta-analytic evidence from Double et al. (2020) demonstrates that structured peer-based assessment bolsters

academic performance by encouraging evaluative judgement and promoting deeper, feedback-driven cognitive processing.

In more specialized contexts, Maccabe and Fonseca (2021) highlight that peer collaboration can trigger moments of conceptual insight—so-called “lightbulb moments”—allowing students to resolve complex disciplinary problems through shared reasoning and emotional reassurance. Gunawan and Huwae (2022) further emphasize the adaptive dimension of peer support, showing that students from underserved regions demonstrate greater academic resilience when they receive emotional and academic assistance from peers. This adaptive function is echoed in Marley and Wilcox’s (2022) study of first-year college students, which shows that peer support boosts early academic motivation and helps students navigate challenging transitional periods.

Recent studies also show a shift toward examining the psychological mechanisms through which peer support affects academic outcomes. Parmar et al. (2025) emphasize that peer support among postgraduate health science students enriches confidence and fosters more meaningful participation by promoting academic and emotional exchanges within learning groups. Zhu et al. (2025) expand this view by identifying a sequential psychological pathway in which peer support cultivates academic hope, reinforces professional identity, and ultimately improves academic adjustment. Yang and Xiang (2025) observe a similar multi-layered dynamic, finding that peer support influences engagement through mediated pathways that vary with contextual factors, underscoring the complexity of peer interactions in contemporary learning environments.

The synthesis of the reviewed literature indicates that Digital Literacy (DL), Self-Regulated Learning (SRL), and Peer Support (PS) collectively form a triadic framework that substantially shapes students’ academic achievement in hybrid learning contexts. Evidence suggests that DL provides the foundational cognitive and technical skills required to navigate digital platforms and access educational content effectively (Ahmed & Roche, 2021; Naz et al., 2022). SRL, in turn, functions as a regulatory mechanism through which students translate digital competencies into goal-directed learning behaviors, including planning, monitoring, and reflective evaluation (Alotaibi et al., 2017; Martin et al., 2022). Meanwhile, PS acts as a socio-emotional and cognitive scaffold that reinforces motivation, engagement, and resilience, thereby enhancing the effectiveness of both DL and SRL (Russell et al., 2017; Parmar et al., 2025; Zhu et al., 2025). The interplay of these three factors illustrates a multi-level pathway: digital competencies facilitate self-regulation, which is amplified by supportive peer interactions, leading to improved academic outcomes.

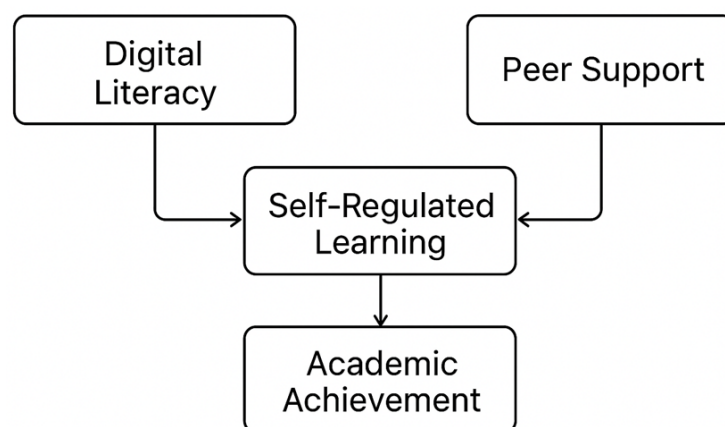


Figure 1. Conceptual Model

Taken together, the reviewed studies reveal a consistent structural pattern shaping how students navigate hybrid learning environments. Rather than isolated findings, these insights converge into a coherent pathway linking cognitive competencies, self-regulatory processes, and social support. Figure 1 captures this integrative logic, illustrating how Digital Literacy (DL) and Peer Support (PS) jointly enhance Self-Regulated Learning (SRL), which in turn drives academic achievement.

The figure visualizes the integrative pathway emerging from the literature, positioning Self-Regulated Learning (SRL) as the central mechanism through which Digital Literacy (DL) and Peer Support (PS) shape students' academic achievement. The model positions SRL as the central mechanism through which DL and PS exert their influence. DL provides the cognitive, technical, and evaluative skills needed to engage digital platforms, while PS offers socio-emotional and collaborative scaffolding that strengthens motivation and engagement. These inputs feed into SRL, enabling purposeful actions such as planning, monitoring, and reflective evaluation—ultimately improving academic performance in hybrid contexts.

The theoretical implications reinforce the interdependence of cognitive, motivational, and socio-relational factors. First, DL is shown to extend beyond operational skills toward metacognitive and evaluative capabilities (Mokhtari, 2023; Jaya & Sucipto, 2023). Second, the consistent mediating role of SRL aligns with Self-Regulated Learning Theory, emphasizing strategic planning, goal-setting, and self-monitoring as essential for digitally mediated learning (Elesio, 2023; Faza & Lestari, 2025). Third, PS functions through layered pathways—including cognitive feedback, emotional reinforcement, and psychological mediation such as academic hope and identity (Gunawan & Huwae, 2022; Yang & Xiang, 2025; Parmar et al., 2025). Together, these insights establish hybrid learning effectiveness as the product of integrated cognitive, self-regulatory, and social processes.

CONCLUSION

This study concludes that the interplay among digital literacy, peer support, self-regulated learning (SRL), and academic achievement forms a mutually reinforcing learning ecosystem in hybrid education. The synthesis indicates that digital literacy serves as a cognitive foundation enabling students to access, filter, and integrate information effectively, thereby strengthening key SRL processes such as planning, monitoring, and self-evaluation. Peer support further contributes through motivational, emotional, and collaborative reinforcement, facilitating strategy exchange, feedback, and shared academic norms. When digital literacy and peer support operate simultaneously, they elevate SRL, which functions as the primary mediator linking both variables to academic performance. These integrated patterns demonstrate that student achievement in hybrid learning emerges from the synergy between technological competencies, social support structures, and mature self-regulation. This answers the research questions and fulfills the research objectives by mapping the roles, relationships, and mechanisms through which DL, PS, and SRL drive academic success.

From a practical standpoint, the findings highlight three key strategies for strengthening hybrid learning environments. First, institutions should design digital literacy programs that extend beyond technical skills to cultivate evaluative and reflective capabilities, enabling students to critically engage with digital content. Second, SRL-supportive practices, such as structured goal setting, progress monitoring, and reflective activities, should be embedded across online and blended curricula to foster autonomous learning. Third, peer support mechanisms must be intentionally structured, both digitally and face-to-face, through mentoring systems, collaborative group tasks, and feedback loops that promote cognitive and emotional scaffolding. Holistically integrating these three components can enhance engagement, motivation, and academic performance in hybrid learning ecosystems.

Several limitations must be acknowledged: most studies used cross-sectional or self-report designs, limiting causal inference, many were confined to higher education contexts, reducing generalizability, and inconsistencies in measuring peer support and SRL hinder comparability. Rapid developments in hybrid technologies and pedagogy further underscore the need for longitudinal or experimental approaches to capture evolving digital, self-regulatory, and social processes. Future research should incorporate mixed-methods or longitudinal designs, broaden samples across diverse digital platforms or sectors, and examine mediating or moderating variables such as digital self-efficacy, perceived risk, and technological literacy. Integrating subjective measures with objective indicators, including log data, behavioral analytics, or digital traces, will enhance model accuracy and provide a more realistic understanding of user–system interaction.

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