

Research Article

Exploring Multidimensional Relationships between Educational Situation Perception, Teacher Support, Digital Learning Engagement, and Academic Self-Efficacy in Elementary School

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Abstract: This study examines the structural relationships among students' perceptions of the learning environment, perceived teacher support, academic self-efficacy, and students' engagement in digital learning in elementary school digital learning contexts. A quantitative survey approach was employed, and the data were analyzed using Partial Least Squares-Structural Equation Modeling (PLS-SEM). The findings reveal that academic self-efficacy significantly predicts students' participation in digital learning activities. Teacher support significantly contributes to strengthening academic self-efficacy and indirectly influences digital learning engagement through the improvement of students' academic confidence. In contrast, educational situation perception does not show a significant direct relationship with either academic self-efficacy or digital learning engagement. The sequential mediation pathway involving teacher support and academic self-efficacy is statistically confirmed. The model demonstrates satisfactory explanatory power and predictive relevance. The results suggest that psychologically driven factors supported by effective pedagogical practices play a more central role in fostering students' digital engagement than contextual perceptions operating independently. These findings highlight the mediating role of academic self-efficacy within the multidimensional framework tested in this study.

Keywords: educational situation perception, teacher support, academic self-efficacy, digital learning engagement, elementary school students

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INTRODUCTION

Digital transformation in basic education has intensified the integration of technology into the learning process. Student digital engagement has emerged as a critical issue, referring to the extent to which students participate cognitively, emotionally, and behaviorally in technology-based learning environments. Liu et al. (2022) reported that students' perceptions of the learning environment are related to self-regulation and learning engagement. (Feng et al., 2023) found that the quality of teacher-student interaction is associated with students' cognitive engagement. Evidence from elementary schools in Indonesia indicates that the structured use of digital platforms such as Quizizz and Wordwall correlates with higher levels of student participation (Farazwati et al., 2025). These findings suggest that digital engagement at the elementary level is shaped not only by access to technology but also by pedagogical management.

Teacher support in digital learning represents a central factor in explaining variations in student learning experiences. (Pan, 2022) showed that instructional support in online settings is positively related to learning engagement. Chang et al. (2022) further demonstrated that students' perceptions of task value assigned by teachers are linked to the emotional dimension of engagement. Research conducted in Indonesian elementary schools revealed that teacher interaction through digital media and guidance in technology use are associated with student engagement in learning activities (Sonhaji, 2025). Effective management of online communication and consistent feedback also contribute to increased motivation and participation (Holifah et al., 2025). In digital contexts, teacher support can be reflected in instructional clarity, quality of feedback, intensity of academic interaction, and facilitation of technology-based discussions.

Academic self-efficacy is regarded as a central psychological construct that plays an important role in shaping students' motivation and academic outcomes. Wang et al. (2024) identified a significant positive association between academic self-efficacy and students' learning achievement. Sun et al. (2025) underscored the importance of self-efficacy in structural frameworks that connect instructional assistance with learning engagement. Perceptions of one's academic competence determine the manner in which learners approach technology-based assignments and sustain their involvement in online learning activities. At the elementary level, digital literacy encompasses not only technical proficiency in using devices but also the confidence required to comprehend, evaluate, and apply digital information for academic purposes.

Prior studies have consistently reported relationships between digital learning design, instructional strategies, and student motivation and engagement. Guo et al. (2025) demonstrated that well-structured digital learning design enhances intrinsic motivation and engagement. Yang & Lian (2025) found that learning engagement is associated with academic achievement and student well-being. He et al. (2024) showed that the worked examples strategy in digital environments reduces cognitive load and improves conceptual understanding. Despite these findings, empirical studies that concurrently examine educational situation perception, teacher support, academic self-efficacy, and digital learning engagement within an integrated analytical model at the elementary school level remain scarce.

Understanding the interplay between contextual learning factors and psychological mechanisms is increasingly important in the digitalization of basic education. Getenet et al.

(2024) reported that the effectiveness of adaptive learning is related to student participation levels, while Ghazali et al. (2024) highlighted the association between supportive learning environments, intrinsic motivation, and perseverance. Existing research has generally examined these relationships separately or focused on higher levels of education. Indirect mechanisms linking educational situation perception, teacher support, and academic self-efficacy to digital learning engagement among elementary students therefore remain underexplored. The present study proposes an integrated multidimensional model in the context of digital learning in elementary schools to clarify the contributions of pedagogical and psychological factors to student engagement. The study does not aim to establish causal claims beyond the scope of the statistical analysis conducted.

THEORETICAL FRAMEWORK

Educational Situation Perception

Educational situation perception describes students' interpretations of the overall quality of their learning setting, encompassing aspects such as instructional clarity and patterns of classroom interaction. Wang et al. (2024) reported that positive perceptions of the learning environment are associated with increased academic confidence and student engagement. Aldridge & Blackstock (2024) found that perceptions of classroom climate and instructional practices are related to self-efficacy and learning participation. These findings indicate that educational situation perception serves as an important foundation for perceived support, academic beliefs, and digital learning engagement.

H1: Educational Situation Perception has a positive and significant effect on Teacher Support.

H2: Educational Situation Perception has a positive and significant effect on Academic Self-Efficacy.

H3: Educational Situation Perception has a positive and significant effect on Digital Learning Engagement.

Teacher Support

Teacher support is conceptualized as students' evaluations of the academic and emotional guidance offered by teachers throughout instructional activities (An et al., 2022). Such support is significantly related to learning engagement and motivational factors in technology-based learning contexts. Liang et al. (2026) demonstrated that teacher support is positively associated with students' academic self-efficacy in digital learning environments. Evidence from these studies frames teacher support as a contextual influence that reinforces students' academic confidence.

H4: Teacher Support has a positive and significant effect on Academic Self-Efficacy.

Academic Self-Efficacy

Academic self-efficacy can be understood as students' confidence in their capability to effectively accomplish academic tasks and reach the intended learning objectives (Duan et al., 2024). Within online learning environments, perceived teacher support has been shown to enhance learners' confidence in handling academic challenges, which is reflected in elevated levels of academic self-efficacy within the proposed conceptual framework. Empirical evidence also demonstrates that academic self-efficacy is positively associated with students' learning engagement across diverse educational contexts (Tvedt et al., 2025). These findings indicate that a strong sense of academic competence consistently

corresponds with greater active participation in learning activities, while remaining aligned with previously documented empirical outcomes.

H5: Academic self-efficacy exerts a positive and statistically significant influence on Digital Learning Engagement.

Digital Learning Engagement

This engagement includes active participation, emotional experiences related to learning activities, and mental effort in understanding material within digital environments. Yin & Luo (2024) showed that engagement in online learning contexts demonstrates a positive relationship with students' self-regulatory abilities, such as goal formulation and time allocation. The evidence further suggests that digital learning engagement is shaped by both contextual support and learners' internal capacity to independently regulate their learning processes.

Mediating Role of Academic Self-Efficacy

Academic self-efficacy can be described as an individual's conviction regarding their capability to effectively accomplish academic duties and attain intended learning objectives (Gong & Xu, 2024). Prior research suggests that greater levels of self-efficacy tend to correspond with more intensive engagement in learning processes. In various instructional contexts, teacher support has been shown to indirectly promote student engagement by reinforcing learners' confidence in their academic competence. In this regard, self-efficacy operates as a psychological link connecting instructional support to engagement-related outcomes (Miao & Ma, 2023). Empirical studies using structural equation modeling further confirm that self-efficacy functions as a mediating construct that bridges support-related factors and learner engagement (Nia et al., 2023). Drawing on this body of evidence, the present study positions academic self-efficacy as a central explanatory mechanism through which contextual and environmental influences shape students' participation in digital learning activities.

H6: Academic Self-Efficacy mediates the relationship between Teacher Support and Digital Learning Engagement.

H7: Academic Self-Efficacy mediates the relationship between Educational Situation Perception and Digital Learning Engagement.

H8: Teacher Support mediates the relationship between Educational Situation Perception and Academic Self-Efficacy.

H9: Educational Situation Perception indirectly influences Digital Learning Engagement through Teacher Support and Academic Self-Efficacy.

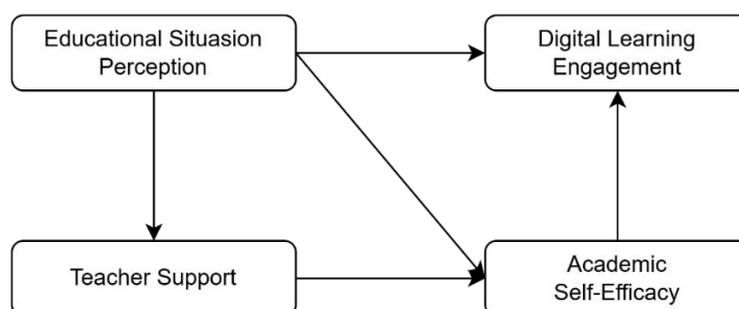


Figure 1. Proposed Structural Model

METHODS

Sample

This research adopted a quantitative survey design to investigate the interrelationships among variables within the context of elementary education. Data were collected from 150 students in Grades IV to VI from public elementary schools located in urban areas of Indonesia that had implemented digital-based learning in classroom activities. The survey approach enabled the collection of students' perceptions through structured instruments and the examination of relationships among constructs using statistical analysis (Wild et al., 2022). This design is appropriate for testing structural models in natural classroom settings without manipulating variables (Nie et al., 2025). The data-gathering process took place directly in classroom settings after formal authorization was granted by school administrators and informed consent was obtained from parents.

The sample consisted of 26% Grade IV students, 42% Grade V students, and 38% Grade VI students. A random sampling technique was applied, ensuring that each student who met the population criteria had an equal and independent probability of being selected as a respondent (Abdullah et al., 2022). The selection of Grades IV to VI was based on students' ability to read, comprehend written instructions, and reflect on their learning experiences, indicating that they were capable of completing the questionnaire independently. The data were self-reported and are therefore interpreted within the limits of statistical associations without inferring causality. The applicability of these results is confined to the specific school contexts included in the investigation.

Instrument

Data were gathered using a structured survey instrument as the main source of primary information, developed in accordance with the conceptual dimensions of Educational Situation Perception, Teacher Support, Digital Learning Engagement, and Academic Self-Efficacy as outlined in prior empirical studies (Liang et al., 2026; Pan, 2022). The items were formulated according to relevant theoretical indicators and adapted to the linguistic characteristics of elementary school students without altering the conceptual meaning of each construct. The questionnaire consisted of 25 statements measured on a five-point Likert scale, scored from 1 indicating strong disagreement to 5 indicating strong agreement. Indicator relevance and clarity of wording were carefully considered during instrument development to ensure students' comprehension. Assessment of construct validity and reliability was conducted by evaluating the measurement model within the PLS-SEM framework.

Table 1. Variable and Statements of the Instrument

Variable	Statements
Educational Situation Perception (ESP)	1. The classroom learning environment makes me feel comfortable.
	2. The learning activities at school are well organized.
	3. The rules in my class help me focus on learning.
	4. The learning materials provided at school are clear and understandable.
	5. The use of digital tools in class supports my learning.
	6. The overall school learning situation helps me learn effectively.
	7. My teacher listens to my ideas during lessons.
	8. My teacher helps me when I have difficulties.

Teacher Support (TS)	<p>9. My teacher encourages me to try my best.</p> <p>10. My teacher explains lessons clearly.</p> <p>11. My teacher gives feedback on my work.</p> <p>12. My teacher motivates me to participate in class.</p>
Digital Learning Engagement (DLE)	<p>13. I actively participate in digital learning activities.</p> <p>14. I complete digital learning tasks on time.</p> <p>15. I pay attention during online or technology-based lessons.</p> <p>16. I try to understand the material when learning using digital media.</p> <p>17. I feel interested when learning with technology.</p> <p>18. I make efforts to solve problems during digital learning.</p> <p>19. I stay focused when using digital tools for learning.</p>
Academic Self-Efficacy (ASE)	<p>20. I am confident that I can complete my school assignments.</p> <p>21. I believe I can understand difficult lessons.</p> <p>22. I can solve learning problems if I try hard.</p> <p>23. I am sure I can achieve good academic results.</p> <p>24. I can stay motivated even when tasks are challenging.</p> <p>25. I believe I can succeed in my studies.</p>

Data Analysis

Data were analyzed using the Partial Least Squares Structural Equation Modeling approach (PLS-SEM) implemented through SmartPLS 4 software. This analytical method was selected because it is appropriate for examining complex structural linkages among latent constructs, particularly in studies with moderate sample sizes and a predictive orientation (Hair et al., 2021). The evaluation began with testing the measurement model to ensure the adequacy of construct validity and reliability. Convergent validity was determined based on outer loadings of at least 0.70 and an AVE value exceeding 0.50. Reliability of the constructs was assessed using composite reliability coefficients ($CR \geq 0.70$) together with Cronbach's alpha values meeting the 0.70 threshold (Hair et al., 2019). Discriminant validity was evaluated through the Heterotrait-Monotrait ratio criterion with values required to be below 0.85, in combination with the Fornell-Larcker approach, which involves comparing the square root of each construct's AVE to the correlations between constructs (Henseler et al., 2015).

The structural model was subsequently examined to test the proposed hypotheses by applying a bootstrapping resampling technique, with statistical significance determined by a t-value greater than 1.96 at the 0.05 level (Hair et al., 2021). The coefficient of determination (R^2) was used to indicate the explanatory power of the model. Additionally, effect size (f^2) and predictive relevance (Q^2) were computed to assess the strength of the relationships and the model's predictive accuracy, where 0.02, 0.15, and 0.35 represent small, moderate, and substantial effects (Hair et al., 2017). Multicollinearity diagnostics were performed using the Variance Inflation Factor, with values not exceeding the tolerance limit of 5 (Hair et al., 2011). All findings were interpreted as statistical associations among constructs rather than evidence of causal inference.

RESULT

Prior to hypothesis testing, the measurement model was examined to confirm construct validity and reliability, with detailed results provided in Table 2.

Table 2 Convergent Validity and Reliability of the Measurement Model

Dimension	Code	Loading	α	CR	AVE
Educational Situation Perception (ESP)	P1	0.803	0.915	0.919	0.653
	P2	0.836			
	P3	0.831			
	P4	0.789			
	P5	0.825			
	P6	0.818			
Teacher Support (TS)	P7	0.680	0.790	0.858	0.669
	P8	0.720			
	P9	0.320			
	P10	0.790			
	P11	0.818			
	P12	0.684			
Digital Learning Engagement (DLE)	P13	0.806	0.906	0.928	0.682
	P14	0.850			
	P15	0.830			
	P16	0.792			
	P17	0.252			
	P18	0.817			
Academic Self-Efficacy (ASE)	P19	0.854	0.835	0.883	0.603
	P20	0.635			
	P21	0.764			
	P22	0.752			
	P23	0.801			
	P24	0.789			
	P25	0.735			

Based on Table 2, five indicators were removed from the initial model due to outer loading values below the recommended threshold of 0.70. These indicators included P7, P9, and P12 under the Teacher Support construct, P17 under the Digital Learning Engagement construct, and P20 under the Academic Self-Efficacy construct. After the refinement process, the indicators retained in the revised model showed loading coefficients that complied with the acceptable cut-off criteria. Both Cronbach’s alpha and Composite Reliability recorded values above 0.70, while the Average Variance Extracted (AVE) surpassed 0.50. This evidence confirms that the measurement model achieved satisfactory internal consistency as well as convergent validity. Discriminant validity was examined through the application of the HTMT ratio and the Fornell-Larcker criterion. The findings demonstrated that every construct exhibited sufficient empirical separation from the others. Detailed outcomes of this assessment are reported in Table 3.

Table 3. Discriminant Validity: HTMT and Fornell-Larcker Criteria

Construct	HTMT				Fornell-Larcker			
	ASE	DLE	ESP	TS	ASE	DLE	ESP	TS
ASE	-	0.825	0.205	0.671	0.776			
DLE	0.825	-	0.209	0.807	0.724	0.826		
ESP	0.205	0.209	-	0.265	0.242	0.251	0.807	
TS	0.671	0.807	0.265	-	0.555	0.687	0.302	0.783

The HTMT coefficients between constructs remained under the recommended limit of 0.85, signifying that discriminant validity requirements were fulfilled. Moreover, the square root of AVE presented along the diagonal elements of the Fornell-Larcker matrix exceeded the corresponding inter-construct correlations. Taken together, these results verify that all constructs met the established standards of discriminant validity. The structural model was then analyzed to explore the proposed relationships among the study constructs.

Table 4. Path Coefficient Results of the Structural Model

Construct Relationship	β (Original Sample)	Standard Error	t-statistic	p-values
ASE \rightarrow DLE	0.704	0.039	17.857	0.000
ESP \rightarrow ASE	0.082	0.074	1.107	0.268
ESP \rightarrow DLE	0.080	0.054	1.473	0.141
ESP \rightarrow TS	0.302	0.073	4.150	0.000
TS \rightarrow ASE	0.531	0.054	9.801	0.000

The results of the structural model evaluation demonstrate that Academic Self-Efficacy positively and significantly predicts Digital Learning Engagement ($\beta = 0.704$; $p < 0.001$). In this study, statistical significance was determined using a threshold of $p < 0.05$. Teacher Support also significantly influences Academic Self-Efficacy ($\beta = 0.531$; $p < 0.001$), while Educational Situation Perception exerts a significant influence on Teacher Support ($\beta = 0.302$; $p < 0.001$). The direct effects of Educational Situation Perception on Academic Self-Efficacy and Digital Learning Engagement were not significant because the p-values exceeded the established significance threshold. These results suggest that Educational Situation Perception functions through indirect pathways within the structural model. The research model is illustrated in Figure 2.

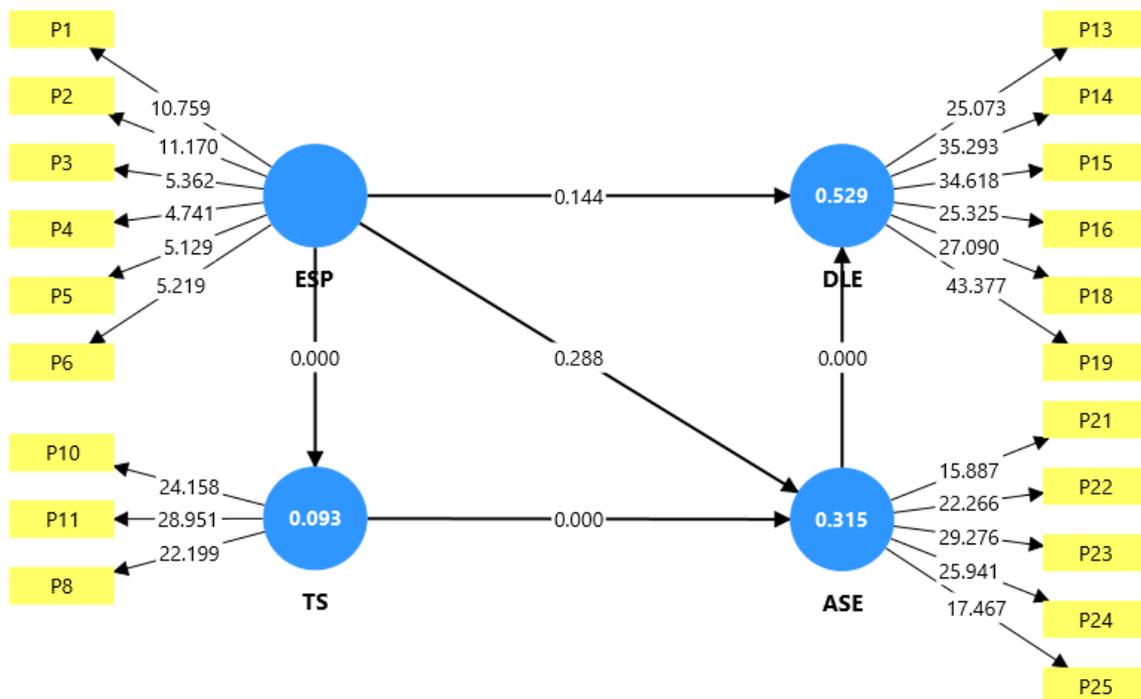


Figure 2. Structural Model with t-Statistics

As shown in Figure 2, the structural model presents the t-statistic values for each significant path. The coefficient of determination (R^2) of 0.529 indicates that 52.9% of the variance in Digital Learning Engagement is explained by the constructs in the model, while the R^2 value of 0.315 indicates that 31.5% of the variance in Academic Self-Efficacy is explained by its predictor constructs. These findings are further supported by the analysis of indirect and total effects, as presented in Table 5.

Table 5. Indirect and Total Effects of the Structural Model

Construct Relationship	Indirect Effect (O)	STDEV	t-statistic	p-value	Total Effect (O)	STDEV	t-statistic	p-value
ESP → ASE → DLE	0.058	0.053	1.091	0.275	-	-	-	-
TS → ASE → DLE	0.374	0.048	7.729	0.000	0.374	0.048	7.729	0.000
ESP → TS → ASE → DLE	0.113	0.030	3.794	0.000	-	-	-	-
ESP → TS → ASE	0.160	0.041	3.892	0.000	0.242	0.073	3.319	0.001
ASE → DLE	-	-	-	-	0.704	0.039	17.857	0.000
ESP → DLE	-	-	-	-	0.251	0.067	3.757	0.000
ESP → TS	-	-	-	-	0.302	0.073	4.150	0.000
TS → ASE	-	-	-	-	0.531	0.054	9.801	0.000

The results of the mediation analysis show that Teacher Support has a significant indirect effect on Digital Learning Engagement through Academic Self-Efficacy ($\beta = 0.374$; $t = 7.729$; $p < 0.001$). Because the indirect effect is identical to the total effect, this finding reflects full mediation by Academic Self-Efficacy. The indirect effect of Educational Situation Perception on Digital Learning Engagement through Academic Self-Efficacy was not significant ($\beta = 0.058$; $t = 1.091$; $p = 0.275$). The sequential mediation pathway through Teacher Support and Academic Self-Efficacy was significant ($\beta = 0.113$; $t = 3.794$; $p < 0.001$).

The effect of Educational Situation Perception on Academic Self-Efficacy through Teacher Support reflects partial mediation, as the indirect effect ($\beta = 0.160$) is smaller than the total effect ($\beta = 0.242$; $p = 0.001$). Although the direct effect of Educational Situation Perception on Digital Learning Engagement was not significant, the significant total effect implies that the association functions indirectly through the mediating variables included in the model, particularly Teacher Support and Academic Self-Efficacy.

Table 6. Result of Coefficient of Determination (R^2), Predictive Relevance (Q^2), Variance Inflation Factor (VIF), and Effect Size (f^2)

Construct	R^2	Q^2	Construct Relationship	VIF	f^2
Academic Self-Efficacy (ASE)	0.315	0.041	TS → ASE	1.102	0.376
			ESP → ASE	1.102	0.008
Digital Learning Engagement (DLE)	0.529	0.046	ASE → DLE	1.061	0.991
			ESP → DLE	1.061	0.013
Teacher Support (TS)	0.093	0.074	ESP → TS	1.000	0.102

The coefficient of determination (R^2) shows that the constructs in the model explain 31.5% of the variance in Academic Self-Efficacy, 52.9% of the variance in Digital Learning Engagement, and 9.3% of the variance in Teacher Support. The positive Q^2 values for all endogenous constructs confirm that the model possesses acceptable predictive relevance. Variance Inflation Factor values below the threshold of 5 indicate that multicollinearity is not a concern within the structural model. The effect size (f^2) analysis reveals a very large effect of Academic Self-Efficacy on Digital Learning Engagement (0.991), a moderate effect of Teacher Support on Academic Self-Efficacy (0.376), and small effects for the remaining paths.

DISCUSSION

Educational Situation Perception and Teacher Support

Educational situation perception and teacher support represent two interrelated contextual aspects in the learning process. Students' perceptions of a structured, clear, and conducive learning environment shape how they evaluate the presence and role of teachers in supporting learning activities. Pan (2022) reported that positively perceived learning environments are associated with stronger perceptions of teacher support, both in terms of instructional guidance and assistance during learning activities, without implying excessive causal claims. Zhang & He (2024) indicated that the quality of the learning context is related to more organized and responsive instructional practices, enabling students to perceive pedagogical support more clearly. Hirata et al. (2024) emphasized that teacher support is primarily reflected in the quality of interactions and attention to students' learning needs, which are strongly influenced by the learning situations experienced by students. This discussion positions teacher support as a reflection of the educational situation as perceived by students in shaping meaningful learning experiences, without overstating empirical findings.

The Role of Academic Self-Efficacy

The results of this study demonstrate that students' beliefs in their academic competence are a crucial determinant of their involvement in digital learning environments. Learners who hold stronger confidence in their academic abilities are more likely to exhibit active and sustained participation in instructional activities. This result is consistent with research indicating a positive linkage between perceived academic capability and academic performance, achieved through motivational pathways such as goal clarity and sustained effort, without assuming direct causal relationships (Saks, 2024). In digital learning contexts, confidence in one's academic ability functions as a psychological factor that helps students respond more adaptively to learning demands.

Perceived academic competence further operates as an underlying psychological process that explains how learning experiences and instructional support relate to student engagement. Previous studies have shown that this construct functions as a mediating variable connecting teacher support with learning achievement, by increasing students' psychological preparedness and willingness to participate in academic activities (Xu, 2024). Other findings suggest that the influence of students' perceived capability on learning outcomes may occur directly or through supporting psychological variables, such as academic commitment, which contribute to students' active involvement in educational tasks (Qadri et al., 2024). The present findings support the role of perceived academic competence as a key explanatory construct in understanding learners' participation patterns within digital learning contexts in elementary schools.

Digital Learning Engagement in the Elementary School Context

The findings indicate that educational situation perception does not have a significant direct effect on digital learning engagement among elementary school students. This result suggests that the perceived condition of the learning environment alone is insufficient to explain levels of digital engagement. A systematic review reported that the use of digital technology in elementary schools may be associated with learning engagement when supported by instructional designs aligned with learning objectives and student characteristics, without demonstrating consistent direct effects (Prihatini et al., 2025). Other research indicates that interaction and collaboration in digital learning environments require clear structure and facilitation to promote meaningful engagement (Schulz et al., 2025).

Digital learning engagement among elementary school students is also influenced by the implementation context and the accompanying pedagogical support. Teachers' perceptions of digital learning applications suggest that technology has the potential to enhance engagement when used purposefully and accompanied by guidance, without assuming automatic improvements in engagement (Pangkey & Gampu, 2025). Research conducted in elementary schools with limited resources shows that digital learning engagement strongly depends on teacher readiness, institutional support, and effective management of learning activities, particularly in settings that require student autonomy (Aloovi, 2025). These findings are consistent with the present results, indicating that the influence of educational situation perception on digital learning engagement is better understood through indirect mechanisms and supportive pedagogical contexts. At the elementary level, environmental conditions do not automatically generate digital engagement without pedagogical support and strengthened academic confidence. Psychological factors function as connecting mechanisms that translate learning contexts into active learning responses.

Mediating Effects of Academic Self-Efficacy and Teacher Support

The mediation analysis indicates that teacher assistance contributes to digital learning engagement indirectly by enhancing students' perceived academic competence. Students' beliefs about their own academic capability operate as an explanatory psychological process connecting teacher support with engagement, particularly in technology-based instructional settings. This result aligns with prior research demonstrating that the effect of teacher support on learning engagement is partially transmitted through increased academic confidence, while a direct influence of teacher support may still persist (Shao et al., 2025; Sun et al., 2025). These findings indicate that students' perceived competence amplifies the link between instructional context and learning behaviors, rather than serving as the only factor determining engagement.

Evidence from online and digital learning environments further confirms the intermediary function of perceived academic competence, where teacher support promotes engagement by strengthening students' confidence in their academic abilities (Huang & Wang, 2023). Both academic and emotional support are associated with enhanced academic self-efficacy, which in turn relates to higher engagement, particularly in activities requiring self-regulation (Wang et al., 2024). Other findings suggest that this mechanism may be partial, as teacher support continues to show a direct relationship with engagement alongside its indirect influence through students' perceived competence (Guo et al., 2025). These findings are consistent with the present results, indicating that the association between teacher support and elementary students' participation in digital learning is more accurately interpreted through

mediation processes, potentially including sequential pathways, rather than solely through direct effects.

The distinctive context of this study lies in the early stage of digital literacy integration in elementary schools, where digitalization remains gradual and not fully institutionalized. Successful implementation in this context is influenced by institutional support, teacher readiness, and parental involvement in fostering reading habits and purposeful digital media use (Aprilia, 2025). These findings imply that teachers need to implement structured and contextualized digital literacy strategies to ensure that literacy development becomes effective and sustainable, as reflected in elementary school literacy practices emphasizing consistency and collaboration (Ningrum et al., 2024).

CONCLUSION

This study offers a broader and more integrated explanation of the interconnections between students' perceptions of their educational environment, teacher support, perceived academic competence, and digital learning engagement in elementary-level technology-based learning settings. The findings indicate that perceived academic competence serves as a central explanatory pathway connecting instructional support to students' engagement in digital learning activities. This study is limited by its cross-sectional design and reliance on self-reported data, which may introduce perceptual bias. The contextual limitations of the sample also require cautious generalization of the findings. From a practical perspective, the implementation of digital-based learning in classrooms should be accompanied by clear instruction, consistent academic feedback, guidance in the use of digital media, and gradually structured assignments that allow students to experience academic success and strengthen their confidence. Strengthening pedagogical support is essential to ensure that technology use extends beyond technical application and contributes meaningfully to student engagement.

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