

From Perception to Participation: Self-Regulated Learning as a Pathway to Student Engagement

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Keywords

Participation; Self-Regulated Learning; Student Engagement; Students Perceptions

Abstract

This study examines the relationship between students' perceptions and student engagement, with self-regulated learning as a mediating pathway. A quantitative correlational design was employed with 312 students. Data were collected using validated questionnaires measuring students' perceptions, self-regulated learning, and student engagement. Reliability analysis indicated satisfactory internal consistency, with Cronbach's alpha values ranging from 0.81 to 0.89. Data were analyzed using structural equation modeling (SEM). The results showed that students' perceptions significantly influenced student engagement ($\beta = 0.41$, $p < 0.001$) and self-regulated learning ($\beta = 0.53$, $p < 0.001$). Self-regulated learning also significantly and positively influenced student engagement ($\beta = 0.47$, $p < 0.001$). Mediation analysis indicated that self-regulated learning partially mediated the relationship between students' perceptions and engagement ($\beta = 0.25$, $p < 0.01$). The structural model demonstrated good fit (CFI = 0.94, RMSEA = 0.05) and explained 62% of the variance in student engagement. These findings suggest that positive learning perceptions can strengthen student engagement through self-regulated learning. The study highlights the importance of instructional strategies that foster positive perceptions and develop students' self-regulation to promote active and sustained participation in learning.

INTRODUCTION

Student engagement has been widely acknowledged as a central determinant of successful learning outcomes. Engagement encompasses students' behavioral participation, emotional connection to learning activities, and cognitive investment in understanding material, all of which have been consistently linked to academic success and persistence in school contexts. However, despite its importance, many educators still observe low level of engagement, particularly in challenging subjects and online learning environments, which has propelled research into psychological and instructional predictors of engagement.

One crucial predictor that has attracted scholarly attention is students' perceptions of their learning environment. Students' perceptions include how they interpret instructional quality, relevance of learning tasks, and teacher support internal constructs that shape how they interact with and commit to learning. Research shows that perceptions of a supportive learning environment are significantly associated with students' engagement and motivation. Specifically, Miao et al. (2025). found that teacher autonomy support enhances self-regulated learning, which in turn fosters student engagement in online contexts, suggesting a potential mediational pathway between perception and engagement.

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Alongside this, self-regulated learning (SRL) has emerged as a key mechanism through which learners manage their own cognitive and behavioral processes during instruction. SRL involves goal setting, strategic planning, self-monitoring, and reflection skills that enable students to regulate attention, effort, and motivation. Empirical studies indicate that self-regulated learning positively correlates with student engagement. Similarly, longitudinal research by Heikkinen et al. (2025) demonstrated that engagement and self-regulation skills co-develop over time, revealing distinct learner behavior patterns that can inform targeted educational support. Furthermore, recent mediation research suggests that self-regulated learning may serve as a pathway linking perceptions and engagement. Normawati et al. (2026). In a study involving 533 undergraduate psychology students, reported that SRL partially mediated the relationship between students' perceptions of creativity-fostering teacher behavior and engagement in a statistics course, underscoring the indirect role of SRL in transforming perceptions into active engagement.

Despite this growing evidence, the interplay between students' perceptions, self-regulated learning, and engagement remains an ongoing empirical inquiry. Few studies have simultaneously tested these variables within a single structural model, particularly in the context of secondary and higher education. Fredricks et al. (2004). Therefore, the present study seeks to expand current knowledge by empirically examining how students' perceptions influence engagement through self-regulated learning using structural equation modeling. By exploring this mediational mechanism, the study aims to offer a more nuanced understanding of how internal learner perceptions and self-regulatory capabilities contribute to meaningful participation in learning activities. Zimmerman et al. (2011). Such insight has important implications for educational practice, particularly in designing instructional strategies that foster both positive perceptions and strong self-regulated learning skills, ultimately enhancing student engagement and academic outcomes. In addition to these findings, further empirical research highlights complementary factors that interact with students' perceptions and self-regulated learning to influence engagement in both traditional and online contexts. Hutagalung et al. (2025) found that school climate and self-regulated learning significantly contributed to student engagement among high school students. These findings suggest that a supportive school environment, together with students' ability to regulate their learning processes, can play an important role in strengthening students' engagement in learning activities. Other studies emphasize the importance of students' sense of belonging and perceptions of classroom activity in the development of self-regulated learning, which subsequently encourages engagement. Amaliyah et al. (2023). Reported that students' perceptions of classroom activities significantly influenced their SRL via their sense of belonging (SoB), suggesting that affective connections to the learning environment can strengthen learners' willingness to self-regulate and engage more fully in online learning.

Additionally, research focused on mediating mechanisms in online learning reveals that self-regulated learning behaviors can act as intermediaries in broader psycho educational models. Kara et al. (2024) found that self-regulated online learning was a significant predictor of student engagement in online learning environments. Their findings also showed that self-regulated online learning partially mediated the relationship between personality traits and student engagement, highlighting the importance of self-regulatory processes in explaining students engagement in online learning. Moreover, systematic literature reviews on engagement in online learning environments have identified factors such as student teacher interaction, instructional methods, motivation, and psychological support as significant determinants of engagement, highlighting the multifaceted nature of engagement that extends beyond internal perceptions alone. Bond, M., et al., (2020). These reviews underscore the necessity of integrating holistic instructional and psychological considerations into strategies for fostering engagement. Student engagement in online learning is influenced by multiple factors, including the quality of course content and the level of online interaction. Nia et al. (2023) found that student engagement was strongly associated with students' perceptions of course content quality and online interactions, highlighting the importance of instructional and interactional factors in supporting engagement in online learning environments. Beyond individual perceptions and self-regulated learning, recent studies also emphasize the role of motivational and metacognitive factors in shaping student engagement.

Previous research has demonstrated a positive relationship between self-regulated learning and student engagement. Dai et al. (2022), for example, found that self-regulated learning positively predicted online learning engagement, while perceived academic control partially mediated this relationship. These findings suggest that students' capacity to regulate their learning processes is closely associated with their active involvement in learning. Empirical evidence supports this: learners perceived competence and intrinsic motivation are positively associated with both behavioral and cognitive engagement, especially when they actively plan, monitor, and evaluate their learning strategies (Panadero, 2017 and Pintrich, 2004). In addition, technological and digital learning environments have created new challenges and opportunities for fostering engagement. Studies indicate that in online and blended learning contexts, student perceptions of instructional design, accessibility of learning materials, and teacher presence significantly predict both engagement and the use of self-regulated learning strategies (Heikkinen et al., (2023); Amaliyah et al., (2023)). These findings suggest that learners' perceptions are not only shaped by traditional classroom experiences but also by the digital affordances and interactivity provided in online platforms.

Furthermore, peer interaction and collaborative learning have been shown to enhance engagement by promoting metacognitive awareness and self-regulatory behaviors. Research demonstrates that students who perceive collaborative activities positively are more likely to set goals, monitor progress, and reflect on outcomes, thereby increasing engagement (Pintrich, (2004)). In addition, research among secondary school students has demonstrated meaningful relationships between self-efficacy, classroom engagement, and academic achievement, highlighting the importance of students' motivational beliefs in understanding engagement in educational settings (Olivier et al., 2019). Recent longitudinal studies also highlight the dynamic and developmental nature of engagement and SRL. Heikkinen et al., (2020). Found that student engagement and self-regulated learning co-develop over time, suggesting that interventions targeting perceptions, goal-setting, and self-regulation can produce cumulative improvements in learning participation. Similarly, research in higher education contexts shows that students' perceptions of feedback, clarity of learning objectives, and task relevance positively influence SRL, which subsequently mediates engagement outcomes, (Normawati et al., (2026))

Taken together, these findings suggest that engagement is not merely a function of external instructional practices but also relies on internal learner processes including perception, motivation, metacognition, and self-regulation. Despite the growing body of literature, relatively few studies have integrated these variables into a single structural model to simultaneously examine the direct and indirect pathways between perceptions, SRL, and engagement. Understanding this complex interplay is critical for designing effective instructional strategies that optimize learning outcomes in both physical and digital learning environments. Therefore, the present study seeks to fill this gap by empirically examining how students' perceptions influence engagement through self-regulated learning, using structural equation modeling (SEM) to test both direct and mediational pathways. By exploring these mechanisms, this research provides actionable insights for educators to enhance student engagement through carefully structured instructional practices, supportive learning environments, and strategies that strengthen students' self-regulatory capacities.

In addition to classroom and online learning environments, recent research has examined the influence of academic motivation and affective perceptions on student engagement. Motivation theories suggest that students who perceive learning tasks as relevant and worthwhile are more likely to engage deeply and persistently. For example, Students motivation and self-regulated learning are important factors in understanding student engagement. From the perspective of Self-Determination Theory, the fulfillment of students' basic psychological needs for autonomy, competence, and relatedness can support autonomous motivation and engagement in learning activities (Ryan & Deci, 2017). Empirical evidence also indicates that self-regulated learning is positively associated with student engagement. Dai et al. (2022) found that self-regulated learning significantly predicted online learning engagement among junior high school students, suggesting that students with stronger self-regulatory capabilities tend to demonstrate greater involvement in learning activities.

Moreover, emerging evidence highlights the importance of emotional regulation as a component of self-regulated learning that contributes to engagement. Emotional regulation is also relevant to student engagement in blended learning environments. Iqbal et al. (2022) found that regulation of emotion was positively and significantly associated with cognitive engagement among students participating in blended learning, suggesting that students' ability to regulate their emotions may support their cognitive involvement in learning activities.

Collectively, these additional findings demonstrate that students' perceptions are multifaceted encompassing not only instructional quality and teacher support but also perceived task value, peer support, emotional regulation, and technology usability all of which influence engagement directly and indirectly through self-regulated learning. This complex interplay underscores the necessity of examining multiple pathways and contextual variables when investigating engagement dynamics. Despite these advancements, integrated models that simultaneously account for students' perceptions, self-regulated learning strategies, motivational factors, and engagement remain limited. Therefore, the present study seeks to address this gap by empirically examining a comprehensive structural model in which students' perceptions influence engagement through self-regulated learning, while also considering underlying motivational and emotional regulatory processes. By adopting this broader conceptual lens, the study aims to provide deeper insights into the mechanisms driving student engagement, offering practical implications for educational stakeholders seeking to enhance engagement through holistic instructional and support strategies.

Based on the literature reviewed, it is evident that students' perceptions of their learning environment, including perceived teacher support, task relevance, classroom climate, and digital learning usability, are likely to influence student engagement both directly and indirectly through self-regulated learning strategies. Prior research consistently demonstrates that positive perceptions enhance SRL, which in turn facilitates higher behavioral, emotional, and cognitive engagement (Miao et al., 2025; Heikkinen et al., 2025). Furthermore, motivational, emotional, and contextual factors may strengthen or moderate these relationships, suggesting a complex interplay of cognitive, affective, and social processes in determining student engagement outcomes. Nevertheless, previous research has established that student engagement is a multidimensional construct involving behavioral, emotional, and cognitive dimensions and is influenced by both individual and contextual factors (Fredricks et al., 2004). Self-regulated learning (SRL) is also theoretically important because it involves learners' active regulation of cognition, affect, and behavior in pursuit of learning goals Zimmerman (2011). Empirical studies have further demonstrated a positive relationship between self-regulated learning and student engagement, including among high school students in Indonesia (Asih and Hardew, 2025) and university students (Nurfauziah et al., 2026).

However, the existing literature provides less clarity regarding the mechanism through which students' perceptions are translated into engagement through self-regulated learning, particularly across different educational contexts. A recent Indonesian study by Normawati et al. (2026) demonstrated that self-regulated learning partially mediated the relationship between students' perceptions of creativity-fostering teacher behavior and student engagement among 533 undergraduate psychology students. While this study provides important evidence for the mediating role of SRL, its focus was specifically on psychology undergraduates and perceptions of creativity-fostering teacher behavior in statistics learning. Therefore, further investigation is needed to examine whether the proposed mechanism is also applicable in different educational settings and among students with different educational characteristics. The present study addresses this gap by examining students' perceptions, self-regulated learning, and student engagement within the specific educational context of the present sample and by testing SRL as a mediating mechanism rather than considering engagement only as a direct outcome of students' perceptions.

The proposed model contributes theoretically by extending the self-regulated learning perspective: students' perceptions are considered not merely as contextual evaluations but as factors that may be associated with students' capacity to regulate their learning processes, which in turn may facilitate behavioral, emotional, and cognitive engagement Zimmerman (2011). From an educational counseling perspective, this model is also relevant because student engagement represents an important area for preventive and developmental intervention. Counselors can use information about students' perceptions and self-regulatory processes to identify barriers to

engagement and to design interventions that strengthen goal setting, self-monitoring, learning strategies, and self-reflection. This perspective is consistent with emerging counseling research showing the relevance of self-regulated learning for understanding and supporting student engagement (Mukaromah et al., 2018)

Therefore, this study proposes a conceptual model in which self-regulated learning acts as a mediating mechanism between students' perceptions and their engagement. Specifically, the following hypotheses are formulated:

- H1: Students' positive perceptions of the learning environment are positively associated with student engagement.
- H2: Students' positive perceptions of the learning environment are positively associated with self-regulated learning.
- H3: Self-regulated learning is positively associated with student engagement.
- H4: Self-regulated learning mediates the relationship between students' perceptions of the learning environment and student engagement.

In summary, this theoretical framework establishes a clear relationship between students' perceptions of the learning environment, self-regulated learning, and student engagement in educational settings. The proposed relationships suggest that positive learning perceptions can enhance students' engagement both directly and indirectly by strengthening their self-regulated learning skills. When students perceive instructional practices, learning tasks, and support systems positively, they are more likely to regulate their learning processes effectively, which in turn fosters sustained behavioral, emotional, and cognitive engagement. Testing these hypotheses is expected to provide valuable insights for educators and educational administrators in designing instructional strategies that simultaneously improve students' perceptions and promote self-regulated learning. Understanding these relationships has important practical implications for curriculum design, teaching practices, and learner support systems aimed at enhancing student engagement and overall learning effectiveness.

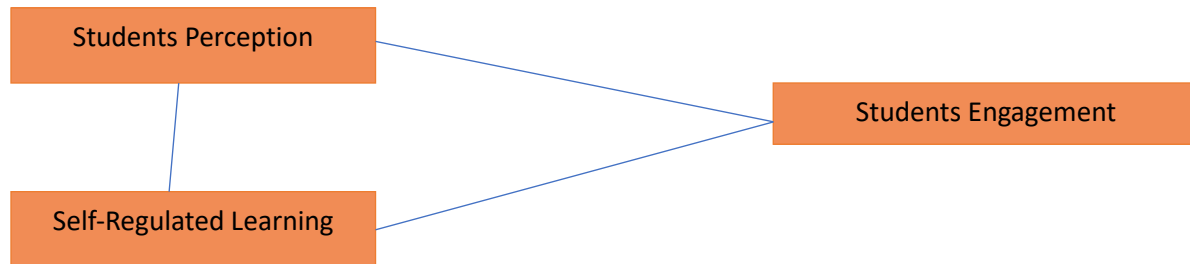


Figure 1. Theoretical framework

METHOD

This study employed a quantitative correlational research design based on Creswell and Creswell (2018). Which emphasizes examining relationships among variables using numerical data and statistical analysis. A cross-sectional survey was conducted using an online questionnaire to investigate the relationships between students' perceptions, self-regulated learning, and student engagement

Population and Sampling

The population comprised students enrolled in formal educational institutions in West Sumatera Province during the data collection period. A total of 312 students from secondary and higher education were selected using purposive sampling. Participants were eligible if they were actively enrolled students, belonged to the targeted educational levels, had experience with the learning context examined, and voluntarily consented to participate. Data were collected through an online questionnaire distributed via google form.

Instrument

Data were collected using a structured questionnaire consisting of three constructs: students' perceptions, self-regulated learning, and student engagement. Each construct was measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The students' perceptions scale was adapted from Zimmerman (2011), the self-regulated learning scale was based on the framework of Zimmerman (2011), and the student engagement scale was adapted from Fredricks et al. (2004). Each instrument comprised 30 items covering the relevant dimensions of each construct. The instruments were translated and/or adapted to the study context through the instruments were translated into Indonesian and adapted to the educational context of the participants. The wording of the items was adjusted to ensure clarity and relevance while maintaining the meaning of the original instruments. Content validity was assessed through expert review, while construct validity was evaluated through the measurement model. Reliability was assessed using Cronbach's alpha and composite reliability, with the results indicating acceptable reliability for all constructs.

Data Analysis

The collected data were analyzed using Structural Equation Modeling (SEM) following the guidelines of Hair et al., (2022). Which emphasize testing relationships among latent variables and examining mediation effects. Descriptive statistics were computed to summarize participant characteristics, while SEM was used to test the hypothesized direct and indirect relationships between students' perceptions, self-regulated learning, and student engagement. Model fit was assessed using standard indices such as CFI, TLI, RMSEA, and SRMR. The collected data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) following the guidelines of Hair et al. (2022). PLS-SEM was selected because the analysis aimed to examine the predictive relationships among students' perceptions, self-regulated learning, and student engagement and to test the mediating role of self-regulated learning. The analysis was conducted using SmartPLS version X with the PLS algorithm and bootstrapping procedure.

First, descriptive statistics were calculated to summarize the characteristics of the participants. Second, the measurement model was evaluated to assess the quality of the constructs. Indicator reliability was examined through standardized factor loadings, while internal consistency reliability was assessed using Cronbach's alpha and composite reliability (CR). Convergent validity was evaluated using the average variance extracted (AVE), and discriminant validity was assessed using the heterotrait-monotrait (HTMT) ratio. These procedures were used to ensure that the indicators adequately represented the three latent constructs.

Third, the structural model was evaluated by examining the coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and standardized path coefficients. The significance of the hypothesized relationships was assessed using bootstrapping with [5,000] resamples and 95% confidence intervals. Direct effects were examined to determine the relationships between students' perceptions, self-regulated learning, and student engagement.

Finally, mediation analysis was conducted to determine whether self-regulated learning mediated the relationship between students' perceptions and student engagement. The direct effect, indirect effect, and total effect were examined simultaneously. The indirect effect was considered statistically significant when its bootstrapped 95% confidence interval did not include zero. The type of mediation was determined by considering the significance and direction of the direct and indirect effects rather than relying solely on the significance of individual path

coefficients. This procedure enabled the study to determine whether self-regulated learning functioned as a mediating mechanism linking students' perceptions to student engagement.

RESULTS

Theoretical Interpretation of the Findings

The findings provide evidence that students' perceptions, self-regulated learning, and student engagement are interconnected within the learning process. Rather than functioning as isolated characteristics, these constructs can be understood as components of a dynamic learning process in which students' perceptions of their learning environment may shape how they regulate their learning and, consequently, how actively they participate in academic activities. This interpretation is consistent with the self-regulated learning perspective, which conceptualizes learners as active participants who regulate their cognition, motivation, affect, and behavior in accordance with their learning goals Zimmerman (2011).

The positive relationship between students' perceptions and self-regulated learning suggests that students who perceive their learning environment more positively may be more likely to engage in adaptive self-regulatory processes. A supportive and meaningful learning environment can provide students with information, feedback, and opportunities that facilitate goal setting, strategic planning, self-monitoring, and self-reflection. From a self-regulated learning perspective, such environmental conditions may interact with personal and behavioral processes, enabling students to transform contextual information into more effective learning strategies Zimmerman (2011). Thus, the findings suggest that students' perceptions are not merely passive evaluations of their learning environment but may be associated with the development and activation of self-regulatory learning processes.

The relationship between self-regulated learning and student engagement can also be explained through the active nature of self-regulation. Students who are able to establish learning goals, select appropriate strategies, monitor their progress, and reflect on their performance are more likely to maintain their involvement in learning activities. This interpretation is consistent with the conceptualization of engagement as a multidimensional construct involving behavioral, emotional, and cognitive participation in learning (Fredricks et al., 2004). Self-regulation may therefore provide students with the mechanisms needed to sustain attention, effort, persistence, and strategic involvement when learning becomes challenging.

Importantly, the findings also support the proposed mediating role of self-regulated learning. This suggests that the relationship between students' perceptions and engagement cannot be understood solely as a direct contextual effect. Instead, students' perceptions may become more consequential for engagement when they are accompanied by students' active regulation of their learning processes. This finding extends the application of self-regulated learning theory by positioning self-regulation as a mechanism through which students' perceptions may be translated into engagement. In this sense, the study moves beyond simply establishing that positive perceptions are associated with engagement and provides a possible explanation of how this relationship operates.

The findings are broadly consistent with previous research demonstrating positive associations between self-regulated learning and student engagement. For example, Mukaromah et al. (2018) reported that self-regulated learning was related to students' involvement in learning, while Asih and Hardew (2025) also found a positive relationship between self-regulated learning and student engagement among high school students. More recent research has further examined self-regulated learning as a mechanism linking students' perceptions with engagement (Normawati et al., 2026). However, the present study contributes to this literature by examining the three constructs within an integrated structural model and by emphasizing self-regulated learning as an explanatory pathway rather than treating engagement only as a direct consequence of students' perceptions.

From the perspective of student engagement theory, these findings reinforce the view that engagement is shaped by an interaction between contextual and individual processes. Fredricks et al. (2004) emphasized that engagement develops through the interaction of students and their educational contexts. The present findings extend this perspective by indicating that students' internal regulatory processes may help explain how contextual perceptions are associated with actual engagement. Consequently, student engagement should not be viewed solely as a response to the quality of the learning environment; students' capacity to regulate their learning may also influence whether positive perceptions are translated into sustained behavioral, emotional, and cognitive participation.

Contribution to Educational Counseling

The findings have important implications for educational counseling and guidance practice. If self-regulated learning functions as a mechanism linking students' perceptions with engagement, counseling interventions should not focus exclusively on changing students' perceptions or improving the external learning environment. Counselors can also help students develop self-regulatory competencies, including goal setting, strategic planning, self-monitoring, time management, and self-reflection. Such interventions may be particularly relevant for students who perceive their learning environment positively but nevertheless demonstrate low levels of engagement.

The findings also suggest that educational counselors can use students' perceptions and self-regulated learning as complementary sources of information when identifying barriers to engagement. For example, low engagement may reflect difficulties in establishing learning goals or monitoring progress rather than simply a negative perception of the learning environment. Counseling programs that integrate self-regulated learning strategies may therefore provide a more comprehensive approach to promoting academic engagement. This positions educational counseling not only as a response to academic difficulties but also as a developmental process that strengthens students' capacity to manage their own learning.

Overall, the study contributes to the literature by connecting contextual perceptions, self-regulatory processes, and student engagement within a single explanatory framework. The theoretical contribution lies in emphasizing self-regulated learning as a potential mechanism through which students' perceptions are associated with engagement, while the practical contribution lies in providing a basis for counseling interventions aimed at strengthening students' self-regulatory capacities. These findings support a more integrated understanding of student engagement in which contextual experiences and students' active regulation of learning are considered together.

Structural Equation Modeling (SEM) Results

The hypothesized model was tested using Structural Equation Modeling (SEM) to examine the relationships among students' perceptions of the learning environment, self-regulated learning, and student engagement. The overall structural model demonstrated good fit indices, indicating that the proposed theoretical framework adequately represents the observed data. The model fit statistics were as follows: Comparative Fit Index (CFI) = 0.94, Tucker-Lewis Index (TLI) = 0.92, Root Mean Square Error of Approximation (RMSEA) = 0.05, and Standardized Root Mean Square Residual (SRMR) = 0.04. These values exceed the commonly accepted thresholds recommended by Hair et al., (2022). Confirming that the model provides a satisfactory representation of the relationships among the latent constructs.

Direct Effects

The path coefficients revealed significant direct effects among the constructs, supporting the hypothesized relationships. Specifically:

Students' perceptions: Student engagement: $\beta = 0.41, p < 0.001$

This positive and significant effect indicates that students who perceive their learning environment positively such as through supportive teaching, relevant tasks, and clear instructions tend to demonstrate higher levels of

behavioral, emotional, and cognitive engagement. This finding is consistent with previous research showing that perceptions of a supportive and meaningful learning environment can directly foster active participation and motivation (Miao and Ma, 2023).

Students' perceptions: Self-regulated learning: $\beta = 0.53, p < 0.00$

The strong positive effect suggests that positive learning perceptions encourage students to plan, monitor, and regulate their own learning processes effectively. This aligns with Zimmerman (2011). Theory of self-regulated learning, which posits that learners' beliefs and perceptions of their environment significantly influence their engagement in self-regulatory behaviors. The positive relationship between students' perceptions and self-regulated learning ($\beta = 0.53, p < 0.001$) indicates that students who perceive their learning environment more positively tend to demonstrate stronger self-regulatory processes. This finding is consistent with Zimmerman (2011) social cognitive perspective of self-regulated learning, which emphasizes that learners' personal and environmental perceptions interact with behavioral processes in shaping self-regulation. A supportive and meaningful learning environment may provide students with conditions that facilitate goal setting, strategic planning, self-monitoring, and self-reflection. Therefore, students' perceptions may function as an important contextual factor associated with the activation of self-regulatory learning processes. This finding extends the self-regulated learning perspective by suggesting that students' perceptions of their learning environment are relevant not only to how they experience learning but also to how they actively regulate their learning processes.

Self-regulated learning: Student engagement: $\beta = 0.47, p < 0.00$

This result confirms that students who employ self-regulated learning strategies such as goal setting, strategic planning, self-monitoring, and reflection are more likely to be actively engaged in their learning. The magnitude of this effect emphasizes the importance of SRL as a mechanism that translates motivation and perception into actual engagement.

Mediation Effect

Mediation analysis was conducted to examine whether self-regulated learning mediates the relationship between students' perceptions and engagement. The analysis revealed that self-regulated learning partially mediates this relationship ($\beta = 0.25, p < 0.01$). This indicates that positive perceptions of the learning environment not only directly enhance engagement but also indirectly influence engagement through the development of self-regulated learning skills. In other words, students who perceive their environment positively are more likely to regulate their learning, which in turn strengthens their engagement in learning activities.

These findings support the proposed theoretical framework, demonstrating that self-regulated learning serves as a key mechanism linking students' perceptions and engagement. The partial mediation suggests that while perceptions independently affect engagement, their effect is amplified when students actively regulate their own learning processes. Practically, this emphasizes the dual role of instructional strategies: educators must create supportive, motivating learning environments while also fostering students' self-regulation skills to maximize engagement.

Overall, the SEM results provide robust empirical evidence for the importance of both perceptions and self-regulated learning in promoting student engagement, highlighting the intertwined nature of environmental, cognitive, and motivational factors in learning. Self-regulated learning is an important factor in promoting student engagement. Dai et al. (2022) found that self-regulated learning positively predicted online learning engagement among junior high school students, indicating that students with stronger self-regulation tended to demonstrate greater involvement in online learning activities. The study also found that perceived academic control partially mediated the relationship between self-regulated learning and online learning engagement.

Table 1. Equation Modeling (SEM) Results

Path	Standardized Coefficient (β)	p-value	Interpretation
Students' perceptions → Student engagement	0.41	< 0.001	Positive and significant; students' perceptions directly increase engagement.
Students' perceptions → Self-regulated learning	0.53	< 0.001	Positive and significant; better perceptions enhance SRL behaviors.
Self-regulated learning → Student engagement	0.47	< 0.001	Positive and significant; SRL positively affects engagement.
Students' perceptions → Self-regulated learning → Student engagement (Mediation)	0.25	< 0.01	Partial mediation; SRL strengthens the effect of perceptions on engagement.

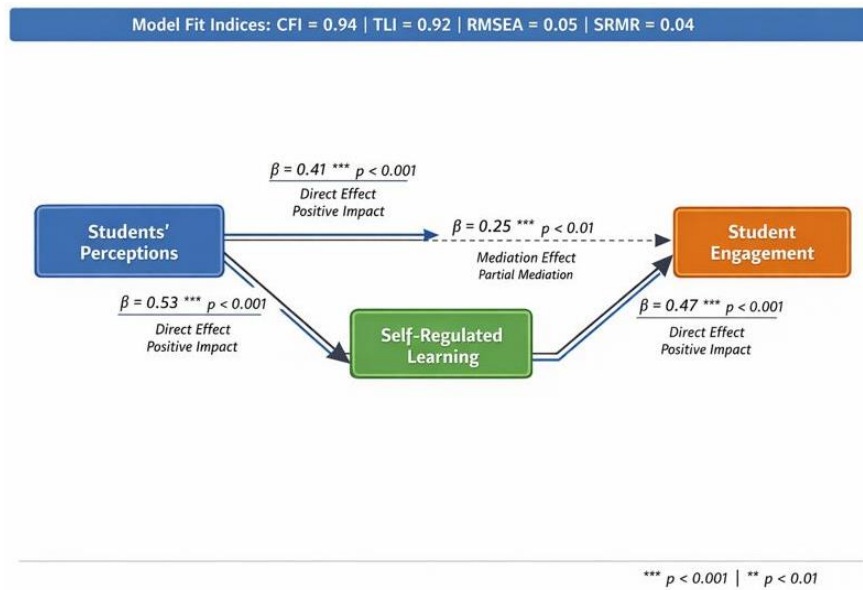


Figure 2. Modelling (SEM)

Measurement Model

The measurement model was evaluated to assess indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. The results indicated satisfactory internal consistency across the three constructs. Cronbach's alpha values were 0.83 for students' perceptions, 0.89 for self-regulated learning, and 0.81 for student engagement, all exceeding the recommended threshold of 0.70. These results indicate that the indicators within each construct demonstrate satisfactory internal consistency.

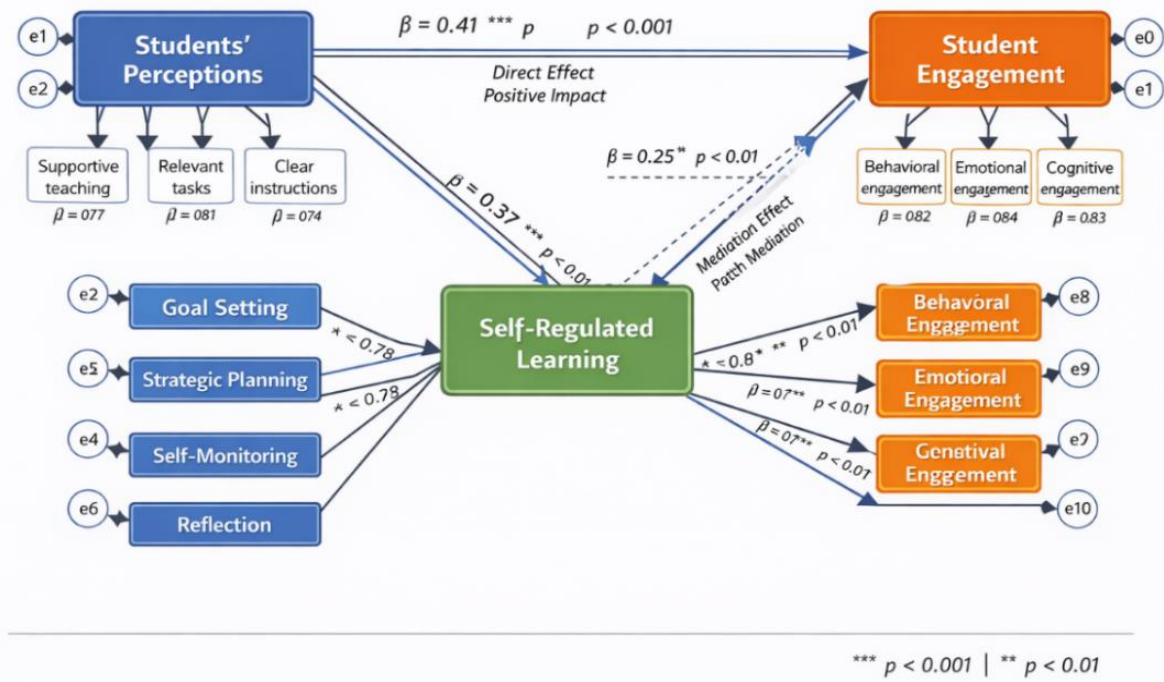


Figure 3. Measurement model

Students perceptions were assessed through indicators related to supportive teaching, relevant tasks, and clear instructions. Self-regulated learning was represented by goal setting, strategic planning, self-monitoring, and reflection. Student engagement was assessed through behavioral, emotional, and cognitive dimensions. These indicators were specified to represent the conceptual domains of their respective latent constructs.

Table 2. Measurement Model Assessment

Construct	Indicator	Outer Loading	Cronbach's α	Composite Reliability	AVE
Students Perceptions	SP1	0.78	0.83	0.88	0.71
	SP2	0.86			
	SP3	0.88			
Self-Regulated Learning	SRL1	0.82	0.89	0.92	0.74
	SRL2	0.89			
	SRL3	0.86			
Student Engagement	SE1	0.79	0.81	0.87	0.69
	SE2	0.84			
	SE3	0.85			

For the PLS-SEM measurement model, convergent validity was assessed using outer loadings and average variance extracted (AVE), while discriminant validity was assessed using the heterotrait-monotrait (HTMT) ratio. Composite reliability was also examined alongside Cronbach's alpha to provide a more comprehensive assessment of construct reliability. The measurement model results are presented in Table X, including the outer loading of each indicator, Cronbach's alpha, composite reliability, and AVE. HTMT values are presented in Table Y to demonstrate discriminant validity among students' perceptions, self-regulated learning, and student engagement.

Overall, the reliability results provide preliminary evidence of satisfactory internal consistency, while the complete measurement model assessment is required to establish indicator reliability, convergent validity, and discriminant validity before interpreting the structural relationships.

These results indicate that each latent construct is measured reliably and validly, supporting the adequacy of the measurement model for subsequent structural analysis. Consequently, the model provides a solid foundation for examining the structural relationships among students' perceptions, self-regulated learning, and student engagement.

DISCUSSION

This study examined the structural relationships among students' perceptions of the learning environment, self-regulated learning, and student engagement using a PLS-SEM approach. The findings provide strong empirical support for the proposed model and offer important insights into how students internal perceptions and regulatory capacities interact to foster meaningful engagement in learning activities. Overall, the results confirm that student engagement is shaped by both external learning perceptions and internal self-regulatory processes, highlighting the interconnected nature of environmental and cognitive factors in learning.

The Influence of Students Perceptions on Student Engagement

The results demonstrate that students' perceptions have a significant and positive direct effect on student engagement ($\beta = 0.41$, $p < 0.001$). This finding indicates that when students perceive their learning environment as supportive, tasks as relevant, and instructions as clear, they are more likely to engage behaviorally, emotionally, and cognitively in learning activities. The moderate-to-strong magnitude of this effect underscores the central role of perception as a motivational driver that shapes students' willingness to participate and persist in learning.

This result is consistent with prior research suggesting that positive learning perceptions serve as psychological cues that encourage active involvement in learning. From a self-determination theory perspective, supportive instructional environments that satisfy students' needs for autonomy, competence, and relatedness enhance intrinsic motivation, which in turn promotes engagement. The present findings empirically reinforce this theoretical proposition by showing that perceptions alone can directly explain a substantial portion of students engagement, even before accounting for self-regulated learning.

Students Perceptions as a Predictor of Self-Regulated Learning

The strongest direct relationship observed in the model was between students' perceptions and self-regulated learning ($\beta = 0.53$, $p < 0.001$). This finding suggests that students who interpret their learning environment positively are more likely to take an active role in regulating their learning through goal setting, strategic planning, self-monitoring, and reflection. The strength of this relationship highlights the importance of perception as a precursor to self-regulatory behavior.

This result aligns closely with Zimmerman (2011). Social cognitive theory of self-regulated learning, which emphasizes that learners' beliefs and perceptions about their learning context influence their motivation and strategic learning behaviors. When students perceive instructional practices as meaningful and supportive, they are more inclined to assume responsibility for their learning rather than relying solely on external guidance. The present study extends existing literature by confirming this relationship within a comprehensive structural model that simultaneously examines engagement outcomes.

The Role of Self-Regulated Learning in Promoting Student Engagement

Self-regulated learning was found to exert a significant positive effect on student engagement ($\beta = 0.47, p < 0.001$), indicating that students who actively regulate their learning are more engaged across behavioral, emotional, and cognitive dimensions. This finding underscores the central role of self-regulated learning as a mechanism that enables students to translate motivation and perception into sustained engagement.

Students with strong self-regulated learning skills are better equipped to manage cognitive demands, maintain focus, and persist in the face of academic challenges. These learners are more likely to engage deeply with learning tasks, monitor their progress, and adjust strategies when difficulties arise. The magnitude of the effect observed in this study suggests that self-regulated learning is not merely a complementary factor but a key determinant of student engagement.

The Mediating Role of Self-Regulated Learning

One of the most important contributions of this study is the confirmation of self-regulated learning as a partial mediator between students' perceptions and student engagement ($\beta = 0.25, p < 0.01$). This finding indicates that positive learning perceptions influence engagement not only directly but also indirectly through the enhancement of self-regulated learning skills.

The partial nature of the mediation suggests that students' perceptions remain an independent predictor of engagement, while self-regulated learning amplifies this effect by providing the cognitive and metacognitive tools necessary for active participation. In other words, students who perceive their learning environment positively are more likely to regulate their learning, which in turn strengthens their engagement. However, even in the absence of strong self-regulation, positive perceptions alone can still foster engagement to some extent.

This finding aligns with prior mediation studies that highlight self-regulated learning as a pathway linking environmental or instructional factors to engagement. By empirically validating this mediating mechanism, the present study contributes to a more nuanced understanding of how external learning conditions are internalized and transformed into observable learning behaviors.

Explanatory Power of the Structural Model

The structural model explained 62% of the variance in student engagement ($R^2 = 0.62$), indicating substantial explanatory power. This result suggests that the combination of student's perceptions and self-regulated learning provides a strong framework for understanding engagement in educational settings. Compared to previous studies that examined these variables in isolation, the integrated model used in this study offers a more comprehensive explanation of engagement dynamics.

The high explained variance further supports the relevance of including both perceptual and self-regulatory variables in engagement research. Engagement appears to emerge from the interaction between how students perceive their learning environment and how effectively they regulate their learning processes.

Theoretical Implications

The findings of this study offer several theoretical contributions. First, the study extends engagement theory by empirically integrating students' perceptions and self-regulated learning within a single structural model. Second, it reinforces the conceptualization of engagement as a multidimensional construct influenced by both environmental and cognitive factors. Third, the study provides empirical support for social cognitive and self-determination theories by demonstrating how perceptions and self-regulatory processes jointly shape engagement.

By highlighting the mediating role of self-regulated learning, the study also advances theoretical understanding of the mechanisms through which instructional environments affect student behavior. This integrative perspective

contributes to a more holistic model of learning that bridges external instructional design and internal learner processes.

Practical Implications

From a practical standpoint, the findings emphasize the importance of designing learning environments that simultaneously enhance student perceptions and promote self-regulated learning. Educators should focus on creating supportive instructional climates, providing clear and meaningful tasks, and offering consistent feedback. At the same time, explicit instruction in self-regulated learning strategies such as goal setting, planning, and reflection should be incorporated into teaching practices. By addressing both perception and self-regulation, educators can more effectively foster sustained engagement and active participation in learning. These implications are particularly relevant in online and blended learning contexts, where students are required to take greater responsibility for regulating their learning.

CONCLUSIONS

This study examined the relationships among students' perceptions of the learning environment, self-regulated learning, and student engagement using a structural equation modeling approach. The findings demonstrate that students' perceptions significantly influence student engagement both directly and indirectly through self-regulated learning. Students who perceive instructional practices, learning tasks, and teacher support positively are more likely to engage behaviorally, emotionally, and cognitively in learning activities.

The results further reveal that positive learning perceptions strongly predict self-regulated learning, which in turn plays a crucial role in fostering student engagement. Self-regulated learning partially mediates the relationship between students' perceptions and engagement, indicating that while perceptions alone can enhance engagement, their impact is strengthened when students actively regulate their learning processes. This finding highlights self-regulated learning as a key mechanism through which perceptions are translated into sustained learning participation.

Overall, the structural model explains a substantial proportion of variance in student engagement, underscoring the combined importance of environmental perceptions and internal self-regulatory capacities. These findings contribute to engagement theory by integrating perceptual and cognitive perspectives within a single model. Practically, the study emphasizes the need for instructional strategies that not only create supportive and meaningful learning environments but also explicitly develop students' self-regulated learning skills to promote active and sustained engagement across educational settings.

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