Original Research Article

CONSTRUCTIVIST LEARNING ENVIRONMENT, CRITICAL THINKING MOTIVATION, SELF-DIRECTED LEARNING READINESS, A STRUCTURAL EQUATION MODEL ON STUDENTS' ENGAGEMENT

ABSTRACT

Aims: The aim of this study is to examine the most suitable model for student engagement using constructivist learning environment, critical thinking motivation, and self-directed learning readiness as exogenous variables and student engagement as endogenous variables.
Study design: The study used Structural Equation Modeling (SEM)
Place and Duration of Study: The study was conducted at public secondary schools in Region XI, Philippines during school year 2023-2024.
Methodology: The study's respondents were Grade 7 students from public secondary schools selected using Raosoft. A four-part questionnaire was employed to collect the data. All items in each indicator received a high Cronbach's alpha coefficient, indicating excellent internal consistency and reliability, suggesting that the instruments are highly reliable.
Results: Results revealed that three out of four variables indicated a high level, while one variable showed very high level. Constructivist learning environment, critical thinking motivation, and self-directed learning readiness yielded significant relationship with student engagement as the endogenous variable. This indicates that students have freedom in their own learning and are determined to succeed. They actively engage in activities that develop their skills and apply what they have learned to real life situations. Out of the three models analyed, Model 3 exhibited indices that aligned that aligned with the criteria for selecting the most appropriate model, which suggests' that the goodness of fit measures are highly acceptable.
Conclusion: The study shows specific indicators have peaked, but activities that enhance student engagement can lead to further improvement. Teachers are encouraged to adopt reflective teaching methods to promote intellectual development and enhance students' learning experiences. Incorporating hands-on activities, such as think-pair-share, inquiry-based learning, problem-solving, and cooperative learning, is also recommended. Promote critical thinking by providing students with activities that stimulate their thinking, such as debates, critical reading, role-playing, and making predictions, to further develop their problem-solving skills. Sustain self-directed learning readiness by giving continuous

Keywords: *Education; constructivist learning environment, critical thinking motivation, self-directed learning readiness, student engagement, SEM, Philippines; SDG 4.*

1. INTRODUCTION

Student disengagement remains a significant challenge for educators (Bennett & Boesdorfer, 2020). This issue contributes to decreased participation in learning activities and rising school dropout rates (Adelman & Taylor, 2022; Blöndal, Kristjánsson, & Sigurðardóttir, 2019). A key factor influencing student engagement is teacher attitude (Olson, Amber, & Peterson, 2020), along with the characteristics of the learning environment (Denessen & Hasselman, 2019). Over-reliance on textbook-based instruction, repetitive exercises, and rote memorization has been shown to hinder student motivation and engagement (Huang, Yating, & Wang, 2023).Furthermore, constructivist learning environment, critical thinking, and self-directed learning readiness plays a pivotal role in fostering student engagement.

The lack of student engagement is attributed to students' self-efficacy, students' interest, participation in class activities, and lack of relevance in subject matter. Furthermore, students may struggle to engage if they lack self-regulation skills and readiness for self-directed learning, leaving them dependent on constant guidance from teachers. Researchers have investigated various variables to develop student engagement, however, a model has not yet to be identified to enhance the students' engagement, and further research is needed to address these issues and improve the overall student engagement.

This study aims to examine the most appropriate model of student engagement in learning, addressing several key questions. First, it seeks to determine the level of the constructivist learning environment, focusing on factors such as constructive activities, knowledge construction, in-depth learning, authenticity, multiple perspectives and prior knowledge, teacher-student interaction, social activity; teacher-student interaction, social interaction, and cooperative dialogue. Second, it aims to identify the level of students' critical thinking, considering expectancy and the task value. Third, it assesses the level of self-directed learning readiness, with a focus on self-management, desire for learning, and self-control. Fourth, it explores the level of student engagement, looking at affective engagement (liking for learning and liking for school), behavioural engagement (effort, persistence, and extracurricular activities), and cognitive engagement. Additionally, the study examines the significant relationships between the constructivist learning environment and student engagement, critical thinking motivation and student engagement, and self-directed learning readiness and student engagement. Finally, it seeks to understand the combined and individual influence of these factors on student engagement and determine the best fit model for fostering student engagement in learning.

In a constructivist learning environment, learners actively construct knowledge through meaningful interactions and problem-solving activities, enhancing their critical thinking abilities (Harjali, 2019; Li & Xue, 2023; Brown, 2020; & Gijbels et al., 2022). This environment encourages students to engage in higher-order thinking processes such as analysis, evaluation, and synthesis, which are essential components of critical thinking (Chen, Wang, & Lin, 2021). Moreover, constructivist learning promotes self-directed learning readiness by empowering students to take responsibility for their learning, set goals, and develop strategies to achieve them (Murawski, 2020; Shcheglova, Yuliya & Parshina, 2019). When students are prepared to learn independently and think critically, they become more

engaged in the learning process, as they find greater relevance and personal meaning in academic tasks (Geng, Law & Niu, 2019).Thus, the synergy between constructivist learning environments, critical thinking, and self-directed learning readiness of students enhances students' engagement leading to deeper and more sustained participation in educational activities (Alfaifi, 2019; Rezaee & Mosalanejad, 2021; Kumar et al., 2021). Educational institutions aiming to improve student engagement should therefore prioritize learning environments that support inquiry, autonomy, and reflective thinking.

In addition, *Engagement Theory* by Kearsley and Shneiderman's (20-23) emphasizes the importance of activities that foster collaboration, to improve students' engagement which also closely align with a constructivist learning environment. It posits that students must take responsibility for their own learning, promoting autonomy. Moreover, the theory highlights the development of students' critical thinking skills, asserting that higher levels of engagement lead to stronger critical thinking abilities. The ultimate goal of this theory is to prepare students for future challenges and changes.

This research plays a significant role in addressing global educational challenges by providing strategies and planning to reduce school dropout rates. Sutton (45) and Delfino (15) demonstrated that students with high levels of participation tend to maintain their interest in learning. Furthermore, engagement serves as a way for students to challenge themselves to actively participate in academic tasks and discussions (Gillies, 200-209; Yadav, 93-96). This study will have a significant impact on both society and educational institutions, particularly in addressing issues related to student performance in Grade 7 learners from Region XI, where a lack of interest and interaction in class activities poses a problem. It will also help students recognize how motivational activities contribute to improved academic performance.

The primary goal of this study is to enhance student engagement, thereby promoting meaningful learning. This aligns with Sustainable Development Goal #4, which emphasizes the importance of inclusive and equitable quality education to foster lifelong learning. By increasing their engagement in learning, students become more aware of social issues, develop critical thinking skills, and participate actively in discussions, exchanging opinions and ideas. This research will also raise awareness in society about the importance of fostering student engagement. It emphasizes how participation-enhancing activities can improve classroom engagement, and the study's findings may serve as a foundation for further enhancing educational practices. The research underscores the relationship between a constructivist learning environment, critical thinking, and self-directed learning readiness in promoting student engagement.

Moreover, it offers practical insights for the Department of Education in Region XI, highlighting strategies to enhance education quality by implementing activities that improve student participation. It also aims to provide teachers and parents with adequate support to foster their children's learning, encourage administrators to meet the needs of both teachers and students, and inspire students to develop a strong interest in learning. Ultimately, this study will serve as a valuable resource for future researchers investigating student engagement and related educational challenges.

2. MATERIALS AND METHODS

2.1 Research Design and Procedures

This study utilized a non-experimental quantitative study using an appropriate Structural Equation Model (SEM) as it is the most suitable method to obtain various types of quantitative data for gathering and collecting data, thoughts, facts, and information related to the investigation of the constructivist learning environment, critical thinking, self-directed learning readiness, and student engagement. The correlational analysis determined the relationship between exogenous variables and students' engagement. Causal research is emphasized as understanding and identifying the causes and effects of phenomena or events (Iacus, King, and Porro, 2019). Additionally, causal research aims to examine and find relationships between variables to explain how and why certain things occur (Kamper, 2020).

The data collection process contained the following steps: obtained adapted questionnaires from reputable journals. The validity of the questionnaires was validated by a panel of experts and had made necessary revisions. The revised questionnaires was submitted to the University of Mindanao Ethics Reviewer Committee (UMERC) for initial review. Once the submitted papers were returned for approval, the researcher was granted a Certificate of Approval with UMERC Protocol No. 2024-093. Compiled the necessary documents, obtained consent letters from the advisor and Dean of Professional Schools. Submitted the approved letters to the Division offices and school principal, administered the questionnaires to the selected respondents, analysed the collected data using mean, Pearson r, multiple regression analysis, and path analysis. The Goodness of Fit Statistics was used for alternative models through Analysis of Moment Structure (AMOS) to identify the most appropriate model, ensuring that each level met the required measurement standards Sidali, Laura, Pizzo, Garrido-Pérez, and Schamel, 2019).

The appropriate model must meet the following standards: Chi/Square/Defress of Freedom (CMIN/DF) should be less than 2 with a P-value higher than 0.05; Root Mean Square Error Approximation (RMSEA) should be below 0.05, with its corresponding P-close value higher than 0.05; and other indices like Normed Fit Index, Tucker-Lewis Index, Comparative Fit Index, and Goodness of Fit Index should be higher than 0.95. These standards ensure that the model accurately represents the meaningful relationships among the variables studied.

The questionnaire underwent relevant changes and modifications to align with the research objectives. The first draft will be adjusted according to the needs and presented to the advisor for revision, comments, and suggestions. To ensure its validity, it was first reviewed by six experts in Filipino and research, including five internal validators and one external validator. The validation results yielded an overall average mean of 4.66. After ensuring its validity, a pilot testing was conducted involving 30 seventh-grade students to determine the Cronbach Alpha, which confirmed the validity of each item analysed by a selected statistician with expertise in research analysis involving four variables. The questionnaire on Constructivist Learning Environment yielded a result of .880. The

questionnaire on Critical Thinking received a result of .826. Meanwhile, the Self-Directed Learning Readiness questionnaire obtained a result of .881, and the Student Engagement questionnaire had a result of .861.

Likert-type scales were also used to calculate and present the Cronbach's alpha coefficient for the internal consistency reliability of any scale or subscale used in the research. In data analysis, summated scales or subscales were used rather than just individual items.

2.2. Research Respondents

This study involved 420 seventh-grade students from various public secondary schools in Region XI during the Academic Year 2023-2024. It was conducted in 9 public secondary schools from each Division in Region XI, with each Division having 39 respondents from the selected school. In determining the respondents, the rule of thumb was followed, where the researcher used the stratified random sampling method (Arevalo, ME and Napil, 2023; Bhardwaj 2019), grouping individuals based on their characteristics before selecting representative participants for the study, as the population is heterogeneous (Iliyasu and Etikan 2021; Berndt 2020, and Oribhabor, Blessing, and Anyanwu, 2019).

The primary respondents in this research are the registered students for the academic year 2023-2024 from seventh grade in public secondary schools in Region XI. The researcher chose seventh-grade students as respondents because, according to Finn (2020), as students advance in grade levels, their participation in learning tends to decrease. However, students from grades eight to ten in public secondary schools are not included in the scope of this research. Additionally, divisions not mentioned in the study of Region XI are also not included.

The researcher ensured that their participation was voluntary. However, they willingly spent their time and effort answering the research without any threat or coercion. They could not have their legal rights and freedoms taken away due to their participation in this research. They were also given the freedom to decline or decide not to continue as respondents if they felt they no longer wished to participate, without facing any penalties or compensation.

2.3 Research Instrument

The four-dimensional questionnaire was developed based on existing materials created and used by reputable scholars and researchers on the topics of constructivist learning environment, critical thinking, self-regulated learning readiness, and student participation. The questionnaire is divided into four sections.

To determine the accurate measurement of the constructivist learning environment, critical thinking motivation, self-directed learning readiness, and student participation among seventh-grade students in public secondary schools, the following scale will be used: A mean range of 4.20-5.00 is categorized as "very high," with the interpretation that the assessment is always demonstrated. A mean range of 3.40-4.19 is categorized as "high," meaning the assessment is frequently demonstrated. A mean range of 2.50-3.39 is

categorized as "moderate," with the interpretation that the assessment is sometimes demonstrated. A mean range of 1.80-2.59 is categorized as "low," meaning the assessment is rarely demonstrated. A mean range of 1.00-1.79 is categorized as "very low," with the interpretation that the assessment is never demonstrated.

3. RESULTS AND DISCUSSION

3.1 Level of Constructivist Learning Environment for Students

Table 1 shows the level of the constructivist learning environment for students, measured through knowledge construction, in-depth learning, authenticity, multiple perspectives, prior knowledge, teacher-student interaction, and social activity. The results indicate an overall standard deviation of 0.45 and a mean score of 4.13, reflecting a high descriptive level.Among the indicators, the teacher-student interaction demonstrates a very high level of the constructivist learning environment, with a standard deviation of 0.53 and a mean score of 4.30. On the other hand, the indicator multiple perspectives achieved the lowest result in the level of the constructivist learning environment, with a standard deviation of 0.58 and a mean score of 4.02.

Table 1. Level of Constructivist Learning Environment for Students

Indicators	SD	Mean	Descriptive Level
Knowledge Construction	0.57	4.05	High
In-depth Learning	0.57	4.10	High
Authenticity	0.58	4.20	Very High
Multiple Perspectives	0.58	4.02	High
Prior Knowledge	0.56	4.09	High
Teacher-Student Interaction	0.53	4.30	Very High
Social Activity	0.53	4.15	High
Overall	**0.45**	**4.13**	High

The results indicate that a high level of the constructivist learning environment suggests that students engage in activities when they feel effective in the tasks they are performing, leading to autonomy and self-evaluation in their learning. This is evidenced by items with the highest levels indicating that students believe the course provides them with opportunities to reflect and contemplate areas for improvement in their skills and knowledge. This is also supported by Harjali's research (2019), which found that students can set their learning goals, which helps them participate more actively in activities by relating them to real life. It also means that students believe the course offers teachers opportunities to reflect on the areas that need development in students' skills and knowledge (Cetin and Dindar 2020; Ahmad, Che Nidzam Che, et al. 2019).

On the other hand, the results also indicate that students view things from different perspectives and consider various viewpoints on an issue. They are open-minded and willing to understand different ways of thinking, even if it contradicts their beliefs. Similar findings were observed in Bryan et al.'s research (2022), which showed that group work allows students to gain a deeper understanding as opportunities for different perspectives and interpretations arise.

3.2 Level of Critical Thinking Among Students

Table 2 shows the level of critical thinking among students, measured by expectancy and task value. The results reveal a standard deviation of 0.48 and an overall mean score of 4.14, reflecting a high descriptive level.

Table 2. Level of Critical Thinking Among Students

Indicators	SD	Mean	Descriptive Level
Expectancy	0.62	4.05	High
Task Value	0.48	4.23	Very High
Overall	**0.48**	**4.14**	**High**

Among the indicators, the **Task Value** demonstrates a very high level of critical thinking among students, with a standard deviation of 0.48 and a mean score of 4.23. In contrast, the **Expectancy** indicator received a lower result for the level of critical thinking, with a standard deviation of 0.62 and a mean score of 4.05.

However, the first item on Task Value achieved an exceptionally high score, with a standard deviation of 0.75 and a mean score of 4.46, indicating that students consider learning proper reasoning to be very important. The results suggest that a high level of task value reflects students' recognition of the importance of developing critical and logical thinking skills. They understand that proper reasoning is crucial for analyzing information, solving problems, and making decisions.

This also implies that students possess advanced critical and analytical thinking skills. Studies by Enciso et al. (2019) and Zainuddin (2020) state that students have the thinking skills and habits necessary for effective problem-solving, decision-making, and intellectual engagement. With critical thinking, students become more responsible for their own learning and are motivated to engage in their studies (Lunney et al., 2023; Murawski, 2023).

The results also show that students have strong belief in their abilities, skills, and judgment. They have a positive outlook on the challenges they face and are determined to succeed. According to a study by Cáceres, Nussbaum, and Ortiz (2020), teachers play a significant role in developing students' critical thinking, as it is a crucial component of learning that they can apply in various contexts. By fostering students' critical thinking, they are prepared to become successful professionals in the future (Erlinda & Paul, 2019).

3.3. Level of Self-Directed Learning Readiness Among Students

Table 3 presents the level of self-directed learning readiness among students, measured by self-management, desire for learning, and self-control. The results show a standard deviation of 0.45 and an overall mean score of 4.21, reflecting a very high descriptive level.

Table 3. Level of Self-Directed Learning Readiness Among Students

Indicator	SD	Mean	Descriptive Level
Self-Management	0.51	4.17	High
Desire for Learning	0.50	4.31	Very High

Self-Control	0.51	4.15	High
Overall	**0.45**	**4.21**	**Very High**

Among the indicators, the **Desire for Learning** demonstrates a very high level of self-directed learning readiness among students, with a standard deviation of 0.50 and a mean score of 4.31. In contrast, the indicator **Self-Control** shows a lower result for self-directed learning readiness among students, with a standard deviation of 0.51 and a mean score of 4.15.

However, within all the items showing a very high descriptive level for the indicator **Desire for Learning**, the first item achieved the highest score, with a standard deviation of 0.74 and a mean score of 4.47, indicating the students' strong desire to learn new information. This suggests that students have a great eagerness to expand their knowledge. It also means that students are well-prepared and capable of managing their own learning processes and overseeing their own education.

The presence of self-directed learning readiness is considered a crucial element in effective learning, as it encompasses students' ability to engage in independent learning (Zeng and Goh, 2018). The results also indicate that students exhibit high initiative in their learning and are actively seeking knowledge, which helps them achieve their goals more effectively. This finding is supported by George (2021), who notes that an individual with self-regulation has the initiative to learn and enhances students' ability to engage in self-reflection and evaluation regarding what needs further development and learning (Geng, Law & Niu, 2019).

3.4 Level of Student Engagement

Table 4 shows the level of student engagement, measured through liking for learning, liking for school, effort and persistence, extracurricular activities, and cognitive engagement. The results reveal a standard deviation of 0.41 and an overall mean score of 4.19, indicating a high descriptive level.

Table 4. Level of Student Engagement

Indicators	SD	Mean	Descriptive Level
Liking for Leaning	0.52	4.11	High
Liking for School	0.60	4.38	Very High
Effort and Persistence	0.40	3.90	High
Extracurricular Activity	0.49	4.28	Very High
Cognitive Engagement	0.50	4.29	Very High
Overall	**0.41**	**4.19**	High

For the analysis of the indicators, the results show that the indicator "Liking for School" has achieved a very high descriptive level, with a standard deviation of 0.60 and a mean score of 4.38. Meanwhile, the indicator "Effort and Persistence" has a standard deviation of 0.40 and a lower mean score of 3.90.

The results indicate that students are not just passive recipients of information. This is supported by the study conducted by Fredricks and McColskey (2021), which highlights that student engagement is crucial in contemporary education and asserts that to succeed

academically, students need to actively participate in the learning process. The results also show that students make efforts to ask questions, engage in discussions, and participate in exchanging ideas.

This is corroborated by research from Mun, Ahmad (2019), and Bender (2020), which suggests that academic success relies on students' involvement in discussions and dialogues. Parsons et al. (2021) emphasized that such involvement leads to students enjoying and being motivated to attend school, actively engaging in their own learning, and feeling a sense of belonging to their school community. This is also supported by Zainuddin, Norziha et al. (2020), who found that it fosters positive behaviors such as regular class attendance, attentiveness to the subject, participation in activities, and its psychological impact on the learning environment (Stephenson et al., 2020).

3.4 1 Relationship Between Constructivist Learning Environment and Student Engagement

Table 5shows the significant relationship between Constructivist Learning Environment and Student Engagement, with an overall result of an r-value of 0.728 and a corresponding probability value of 0.000, which is significantly lower than the 0.05 level of significance set for this study. Therefore, the hypothesis is rejected in favor of the alternative hypothesis, indicating a significant relationship between Constructivist Learning Environment and Student Engagement.

Table 5.a Relationship Between Constructivist Learning Environment and Student Engagement

Constructivist Learning Environment	**Student Engagement**					
	Liking for Learning	Liking for School	Effort and Persistence	Extracurricular Activity	Cognitive Engagement	**Overall**
Knowledge Construction	.466** .000	.390** .000	.478** .000	.528** .000	.495** .000	**.576** .000**
In-depth Learning	.511** .000	.442** .000	.492** .000	.527** .000	.527** .000	**.613** .000**
Authenticity	.479** .000	.409** .000	.472** .000	.561** .000	.600** .000	**.618** .000**
Multiple Perspectives	.433** .000	.337** .000	.470** .000	.552** .000	.538** .000	**.567** .000**
Prior Knowledge	.387** .000	.276** .000	.432** .000	.505** .000	.488** .000	**.506** .000**
Teacher-Student Interaction	.482** .000	.460** .000	.500** .000	.478** .000	.478** .000	**.590** .000**
Social Activity	.518** .000	.469** .000	.539** .000	.532** .000	.561** .000	**.642** .000**
Overall	**.579** .000**	**.491** .000**	**.598** .000**	**.653** .000**	**.654** .000**	**.728** .000**

A high level of the significant relationship between the constructivist learning environment and student engagement indicates that when the constructivist learning

environment is effective and at a high level, student engagement in learning will also be effective and high. The results also show that various aspects of the constructivist learning environment, such as knowledge construction, deep learning, authenticity, diverse perspectives, prior knowledge, teacher-student interaction, and social activities, have a positive relationship with student engagement. This means that students are more engaged in hands-on activities.

The significant relationship between the constructivist learning environment and student engagement is supported by the research of Fernando, Sithara, and Marikar (2021), which demonstrates that constructivist teaching can only be effective if students actively participate in their learning process rather than being passive observers and listeners.

This is also consistent with Dewey's Constructivist Learning Theory (1997), which posits that providing authentic tasks related to real life enhances student engagement. In a constructivist context, students constantly question things. The theory suggests that experience is the primary driver of student engagement rather than passivity. Teachers serve as guides, and students are given responsibility for their own learning.

3.4 2 Relationship Between Critical Thinking and Student Engagement

Table 6 shows the significant relationship between critical thinking and student engagement, with an overall result of an r-value of 0.688 and a corresponding probability value of 0.000, which is lower than the 0.05 significance level set for this study. Therefore, the hypothesis is rejected in favor of the alternative hypothesis, indicating a significant relationship between Critical Thinking and Student Engagement.

Critical Thinking	**Student Engagement**					
	Liking for Learning	Liking for School	Effort and Persistence	Extracurricular Activity	Cognitive Engagement	**Oveall**
Expectancy	.401**	.306**	.442**	.508**	.441**	**.509****
	.000	.000	.000	.000	.000	**.000**
Task Value	.562**	.530**	.572**	.619**	.657**	**.722****
	.000	.000	.000	.000	.000	**.000**
Overall	**.538****	**.461****	**.569****	**.636****	**.611****	**.688****
	.000	**.000**	**.000**	**.000**	**.000**	**.000**

Table 6 Relationship between Critical Thinking and Student Engagement

The section on self-confidence shows a significant relationship across all domains of student engagement. This indicates that students with high expectancy also exhibit higher engagement in their learning, as reflected in their liking for learning, liking for school, effort and persistence, extracurricular activities, and cognitive engagement. Meanwhile, the Task Value also demonstrates a high level of significant relationship across all domains of student engagement, with an r-value of 0.722 and a probability value of 0.000, indicating that the value placed on work is related to all aspects of student engagement. This means that when students place a high value on their work, their engagement in school activities is also high.

The results suggest that as students develop their critical thinking, they also enhance their ability to take personal responsibility for their own learning. Research shows that having high critical thinking skills is considered one of the most important abilities, especially in the 21st century (Lv, 2022). Additionally, the results indicate that having high

critical thinking skills also boosts students' self-confidence, encouraging them to invest more effort and enthusiasm in their academic work, extracurricular activities, and other school-related events. This is supported by the study of Alvarez, Muela, and Larrea (2022), which found that critical thinking is a core purpose of teaching and that it significantly increases students' confidence to participate in classroom activities (Goodsett, 2020). The development of critical thinking and student engagement in activities are interrelated (Davies, 2019).

3.4 3 Relationship Between Self-Directed Learning Readiness and Student Engagement

Table 7 shows the significant relationship between Self-Directed Learning Readiness and Student Engagement, with an overall result of an r-value of 0.838 and a probability value of 0.000, which is significantly lower than the .05 level of significance set for this study. Therefore, the hypothesis is rejected in favor of the alternative hypothesis, indicating a significant relationship between Self-Directed Learning Readiness and Student Engagement.Self-Management has an r-value of 0.581 with a corresponding probability value of 0.000, Desire for Learning has an r-value of 0.819 with a corresponding probability value of 0.000, and Self-Control has an r-value of 0.734 with a corresponding probability value of 0.000.

Theoverall results indicate that a high level of self-directed learning readiness also increases student engagement. It also shows that aspects such as self-management, desire for learning, and self-control have a positive and significant relationship with student engagement. This means that when students exhibit higher levels of self-regulation, a strong desire to learn, and the ability to control themselves, they are more actively engaged in activities. Additionally, the study reveals that a class with a negative climate can decrease students' self-direction and readiness for learning (Alfaifi, 45-52; Rezaee & Mosalanejad, 2019). To enhance students' readiness for learning, teachers should act as guides for the students (Khalid, Nashir & Amin, 2020).

Self-Directed Learning Readiness	**Student Engagement**					
	Liking for Learning	Liking for School	Effort and Persistence	Extracurricular Activity	Cognitive Engagement	**Overall**
Self-Management	.584** .000	.456** .000	.573** .000	.651** .000	.581** .000	**.695** .000**
Desire for Learning	.693** .000	.639** .000	.673** .000	.668** .000	.657** .000	**.819** .000**
Self-Control	.607** .000	.471** .000	.601** .000	.659** .000	.666** .000	**.734** .000**
Overall	**.702** .000**	**.583** .000**	**.688** .000**	**.737** .000**	**.710** .000**	**.838** .000**

Table 7:Relationship between Self-Directed Learning Readiness and Student Engagement

This is supported by Knowles' Adult Learning Theory (1970). This theory emphasizes that an individual engages in self-directed learning and motivation for participation with or without guidance in planning and evaluating their own learning experiences (Knowles, 1970). An individual is motivated to engage and take responsibility for their own learning, needs, and goal-setting to achieve their objectives and self-evaluate. A positive outcome of self-regulation in learning readiness is that it becomes routine for students when they choose.

3.5 Influence of Endogenous and Exogenous Variables

Table 8 shows the influence of Constructivist Learning Environment, Critical Thinking, and Self-Directed Learning Readiness on Student Engagement. The Constant (Intercept) value is 0.930 with a highly significant t-value (8.802) and p-value (0.000), indicating that maintaining all variables at zero, which serves as the baseline for Student Engagement, is significantly different from zero.

Table 8. Significant Influence of Constructivist Learning Environment, Critical Thinking, and Self-Directed Learning Readiness on Student Engagement

	Student Engagement			
(Variables)	*B*	β	*t*	*Sig.*
Constant	.930		8.802	.000
Constructivist Learning Environment	.113	.126	2.621	.009
Critical Thinking	.041	.048	1.076	.282
Self-Directed Learning Readiness	.623	.698	13.942	.000
R	.842			
R^2	.710			
∆R	.707			
F	337.050			
ρ	.000			

Further analysis of endogenous and exogenous variable influences reveals that the Constructivist Learning Environment variable has a beta coefficient (β) of 0.126 and is statistically significant (p = 0.009). This indicates a positive influence between the Constructivist Learning Environment and Student Engagement. For each unit increase in the Constructivist Learning Environment, there is an estimated increase of 0.113 units in student engagement, holding other variables constant.

On the other hand, the Critical Thinking Motivation has a β of 0.048 and a p-value of 0.282, which is not statistically significant. This suggests that Critical Thinking Motivation does not impact student Engagement. Meanwhile, Self-Directed Learning Readiness has a β of 0.698 and a p-value of 0.000, showing a significant influence on student engagement. The effect size of 0.623 indicates a larger effect compared to Constructivist Learning Environment and Critical Thinking Motivation.Regarding Model Fit, the R-squared value of .710 suggests that the combination of these three variables explains approximately 71% of the variance in

student engagement. The change in R (ΔR) indicates a marginal increase in explanatory power when these three variables are added to the model. The F-statistic is significant (ρ = .000), indicating that the model is appropriate.

The results emphasize the importance of having a Constructivist Learning Environment and Self-Directed Learning Readiness to enhance student engagement. It also indicates the need for interventions to improve and increase the Constructivist Learning Environment and Self-Directed Learning Readiness. The relatively high R-squared value suggests that other potential factors not included in this model may significantly influence student engagement. Future research could explore additional variables. The specific context of teaching quality and teaching strategies may also influence these relationships and should be considered in further studies.Bennett & Boesdorfer (2020) have shown that a lack of student engagement is a current challenge for teachers. This issue leads to decreased interest in learning and an increase in dropout rates (Adelman & Taylor, 2022; Newberry, 2022; Blondal, Kristiana, & Sigrun, 2019). Sutton (2021) and Delfino (2019) have proven that students with high engagement levels generally do not lose interest in learning.

Best-Fit Structural Model on Student Engagement

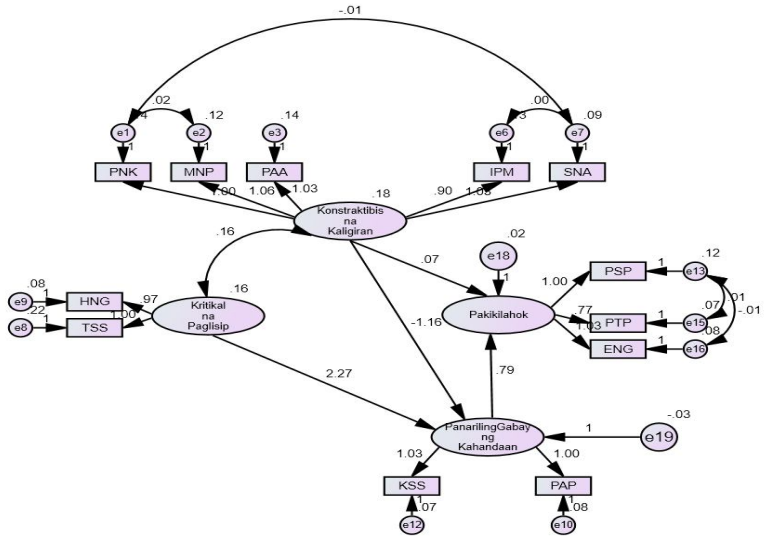

Fig.1Structural Model on Student Engagement

Legend:

Constructivist Learning
PNK-Knowledge Construction
MNP-In-Depth Learning
PAA-Authenticity
IPM-Teacher-Student Interaction
SNA-Social Activity

Self-Directed Learning Readiness
KSS-Self-Management
PAP-Self-Control

Engagement
PSP-Liking for Learning
PTP-Effort and Persistence
ENG-Extracurricular Activity

Critical Thinking
HNG-Task Value
TSS-Expectancy

The seventh objective of this study is to assess the best-fit structural model that describes student engagement, as shown here. This model, depicted in Figure 1, is the output of the Structural Equation Model (SEM). It provides a comprehensive understanding of the factors affecting student engagement, with students being the primary data source. Tables 9 and 10 offer a detailed examination of the validation of these findings. Each table supports the robustness of the model, providing empirical evidence that reinforces the conclusions drawn.

Figure 1 is considered the Best-Fit Structural Model for student engagement. The "Best-Fit Structural Model" typically indicates a statistically and theoretically sound representation of the relationships between the analyzed and investigated variables. In the context of student engagement, Model 3 is designated as the most suitable model based on thorough statistical validation and theoretical consistency. Models 1 and 2, moved to the appendices, serve as comparisons or developmental stages that help illustrate the iterative process of reaching Model 3. They provide insights into the alternative models considered during the research process.

As shown in Figure 1, the findings of the Structural Equation Modeling (SEM) are presented. However, it is notable that two of the exogenous variables retained fewer observed variables. For instance, within 'Constructivist Learning Environment,' five out of seven observed variables were retained. These include Knowledge Construction (PNK), In-depth Learning (MNP), Authenticity (PAA), Teacher-Student Interaction (IPM), and Social Activity (SNA). Two variables, namely Multiple Perspectives (IIP) and Prior Knowledge (DAK), were removed in the SEM process. Regarding 'Critical Thinking,' all observed variables were retained, covering Expectancy (TSS) and Task Value (HNG). SEM removed one observed variable from Self-Directed Learning Readiness, which was the Desire for Learning (PNM). The remaining variables are Self-Control (PAP) and Self-Mangement (KSS). Additionally, two variables, Liking for School (KGP) and Cognitive Engagement (KOP), were removed from the SEM process under 'Student Engagement.' The remaining variables are Liking for Learning (PSP), Effort and Persistence (PTP), and Extracurricular Activities (ENG). The streamlined model allows for a more focused analysis of the relationships between these constructs.

Table 9 shows the Goodness of Fit Measures for the optimal structural model, each of which helps determine how well the model aligns with the observed data. It starts with the

p-value, which in Table 9 is 0.051, slightly above the standard threshold of 0.05. This indicates a good fit, as a p-value above 0.05 suggests no significant difference between the observed and estimated data.

The Normed Chi-Square (CMIN/DF) of the model is 1.373, which falls within the accepted range of 0 to 2, indicating a good fit. The Goodness of Fit Index (GFI) is 0.977, exceeding the benchmark of 0.95, and suggests a good fit with values closer to 1 considered superior.

The Comparative Fit Index (CFI) is 0.995, which is higher than the standard of 0.95, indicating an excellent fit. Similarly, the Normed Fit Index (NFI) at 0.982 surpasses the threshold of 0.95, suggesting a good fit. The Tucker-Lewis Index (TLI), with a value of 0.992, also exceeds the common threshold of 0.95, indicating a very good fit.

Table 9. *The Goodness of Fit Measures of the Structural Best Fit Model*

INDEX	CRITERION	MODEL FIT VALUE
P-value	> 0.05	.051
CMIN/DF	0 < value < 2	1.373
GFI	> 0.95	.977
CFI	> 0.95	.995
NFI	> 0.95	.982
TLI	> 0.95	.992
RMSEA	< 0.05	.030
P-Close	> 0.05	.974

Legend:

CMIN/DF - Chi-Square/Degrees of Freedom
NFI - Normed Fit Index
TLI - Tucker-Lewis Index
CFI - Comparative Fit Index
GFI - Goodness of Fit Index
RMSEA - Root Means Square of Error Approximation
P-close - P of Close Fit

Additionally, the Root Mean Square Error of Approximation (RMSEA) is 0.030, which is below the benchmark of 0.05, suggesting an excellent fit with lower values indicating a better fit than the set threshold. Finally, the P-close value is 0.974, which is higher than the standard of 0.05, indicating a very good fit. In summary, all indices meet or exceed their respective benchmarks, indicating that the models fit the observed data well.

Furthermore, the summary of the Goodness of Fit Measures for the three developed models is shown in Table 10. Each model was evaluated based on several indices, with the optimal model achieving the standards of each index.

Hypothesized Model 1. The P-value is 0.000, which does not meet the established criterion (>0.05), indicating a poor and unsuitable model. The CMIN/DF is 11.738, exceeding the expected range (0<value<2), suggesting a poor and unsuitable model. The GFI (0.738), NFI (0.743), and TLI (0.717) are all below the recommended value (>0.95), indicating that the model is weak and inadequate. The RMSEA is 0.160, which is higher than the acceptable value (<0.05), indicating poor fit. The P-close value is 0.000, which does not meet the criterion (>0.05), suggesting a poor and inadequate fit.

Hypothesized Model 2. In this model, the P-value is 0.000, which does not meet the criterion (>0.05), suggesting a poor fit. The CMIN/DF values are above 2, indicating a poor fit. The GFI, CFI, NFI, and TLI values are below the recommended value (>0.95), suggesting a suboptimal fit. The RMSEA values are higher than the acceptable threshold (<0.05), indicating poor fit. The P-close values are also below 0.05, suggesting poor fit.

Hypothesized Model 3. This model meets all criteria for a good fit. The P-value is 0.051, which is significant compared to the criterion (>0.05). The CMIN/DF value is 1.373, within the acceptable range (0<value<2). The GFI (0.977), CFI (0.995), NFI (0.982), and TLI (0.992) values are above the recommended threshold (>0.95). The RMSEA is 0.030, below the acceptable value (<0.05). The P-close value is 0.974, which is significant compared to the criterion (>0.05). In conclusion, Model 3 is the most appropriate fit for the data among all developed models based on these Goodness of Fit steps.

Table 10. *Summary of Goodness of Fit Measures of the Three Generated Model*

Model	P-value (>0.05)	CMIN / DF (0<value <2)	GFI (>0.95)	CFI (>0.95)	NFI (>0.95)	TLI (>0.95)	RMSEA (<0.05)	P-close (>0.05)
1	.000	11.738	.738	.758	.743	.717	.160	.000
2	.000	3.634	.875	.942	.922	.931	.079	.000
3	.051	1.373	.977	.995	.982	.992	.030	.974

Legend:
CMIN/DF – *Chi Square/Degrees of Freedom*
GFI – Goodness *of Fit Index*
RMSEA – *Root Mean Square of Error Approximation*
NFI –*Normed Fit Index*
TLI -*Tucker-Lewis Index*
CFI – Comparative *FitIndex*

4. CONCLUSION

The use of a structural equation model has strengthened this study as the analysis follows a sequential process of the specific model. The results showed that the levels of constructivist learning environment, critical thinking motivation, and self-directed learning readiness in student engagement are high, indicating that respondents frequently agree with and demonstrate the items related to these variables.

There is a significant relationship between the variables of constructivist learning environment, critical thinking motivation, and self-directed learning readiness, and student engagement. Therefore, the null hypothesis was rejected. Among the three examined models, Model 3 had consistent indices and indicated the best fit for the data. Thus, it was identified as the most appropriate model. The goodness of fit results for Model 3 are highly acceptable as all indices met the established criteria against the values obtained for the most suitable model.

Based on the study's results, the researcher proposes the following recommendations.

Enhance the constructivist learning environment. Although the constructivist learning environment among students is high, it has not reached the highest level. Teachers are

encouraged to adopt reflective teaching methods to promote intellectual development and enhance students' learning experiences. Incorporating hands-on activities, such as think-pair-share, inquiry-based learning, problem-solving, and cooperative learning, is also recommended.

Promote critical thinking. The results showed a high level of critical thinking among students, but it did not reach the highest level. It is suggested to provide students with activities that stimulate their thinking, such as debates, critical reading, role-playing, and making predictions, to further develop their problem-solving skills.

Sustain self-directed learning readiness. Students demonstrated a very high level of self-guidance in readiness to learn. Even though this level has achieved the highest standard, it is recommended to maintain this through effective teaching and learning processes. Continuous activities that expand their minds and positive perspectives should be encouraged.

The research is also supported by Kearsley & Shneiderman's (1998) Engagement Theory, which emphasizes the importance of activities that foster collaboration and student responsibility in their own learning. Additionally, the researcher recommends valuing this study for the selected respondents, particularly seventh-grade students, as it is crucial to start developing and enhancing their engagement from the early stages of education.

CONSENT AND ETHICAL APPROVAL

The research conducted ensured adherence to ethical standards evaluated by the University of Mindanao Review Ethics Committee (UMERC), such as voluntary participation, privacy, confidentiality, written consent process, recruitment, risks, benefits, harm, fabrication, falsification, conflict of interest (COI), deception, permission from organization/location, and authorship.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIX

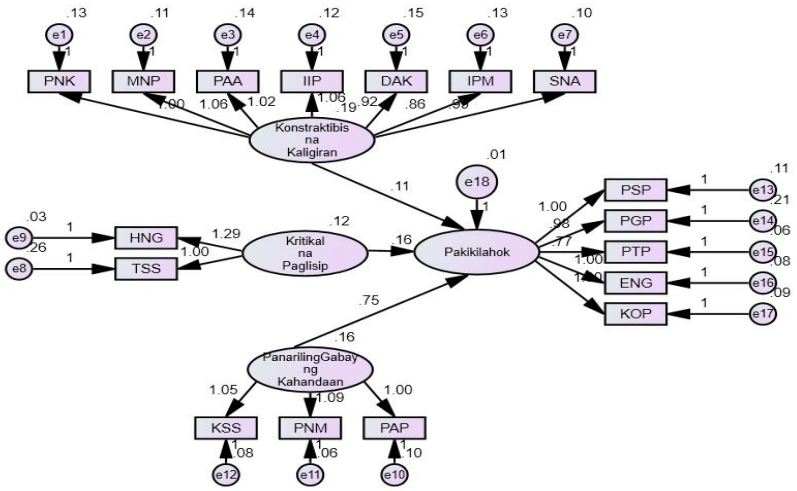

Fig. 2. Structural Model 1

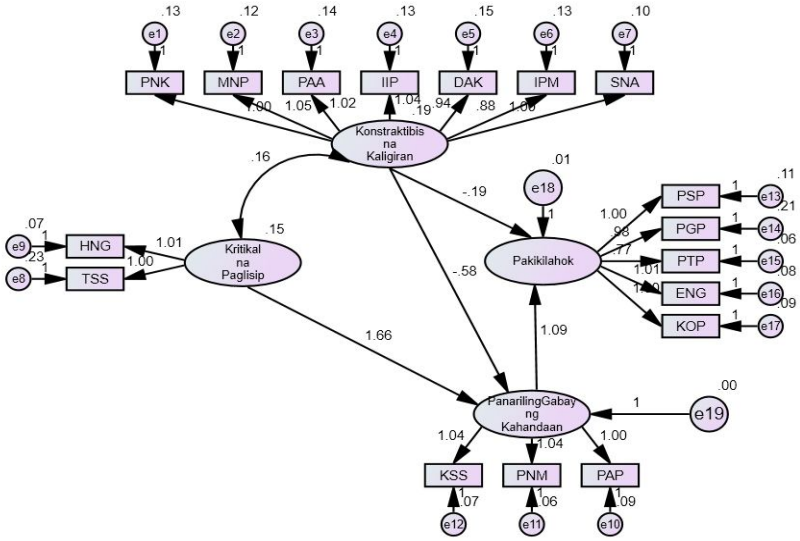

Fig. 3. Structural Model 2

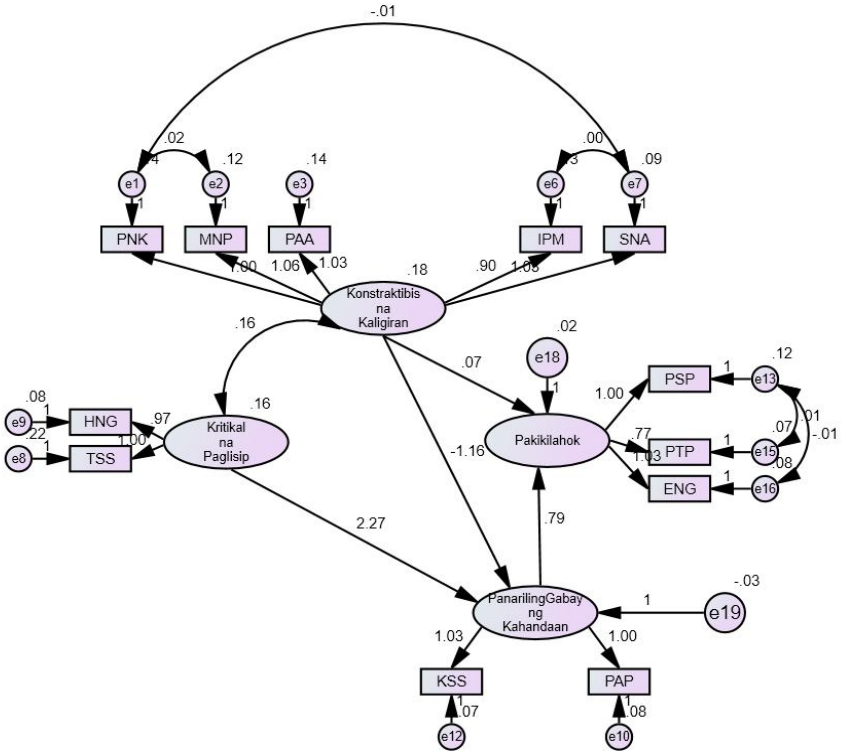

Fig. 4. Structural Model 3