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Teacher's Affective Support and Its Influence Toward Students' Academic Effort and Academic Performance: A Structural Equation Model Approach

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A B S T R A C T

Effective teaching requires connecting with students and addressing their emotional needs. This study examines the relationships among academic performance, effort, self-efficacy, enjoyment, hopelessness, and teachers' affective support in mathematics education. Using PLS-SEM with WarpPLS 7.0, data from 261 Bongabon Senior High School learners were analyzed. Results show that lower-performing students may exert more effort to improve, as academic performance negatively influences effort. Teachers' affective support enhances self-efficacy and belonging but negatively impacts performance. Enjoyment significantly influences effort, self-efficacy, and hopelessness but not performance. Belonging improves self-efficacy and enjoyment but does not affect hopelessness. Findings highlight emotional support's role in fostering self-efficacy and enjoyment, recommending further exploration of mediators and strategies to enhance student achievement.

INTRODUCTION

Education is universally recognized as a fundamental human right and is crucial for individual empowerment, social progress, and economic development. It is the most sustainable investment, and a powerful tool for lifting excluded children and adults out of poverty (UNESCO, n.d.). To reflect the nation's commitment to provide quality education for all its citizens. The Philippines education system has undergone a significant transformation over the years. Now, it follows the 6-4-2 structure or the K-12 Curriculum, consisting of 6 years of primary education, four years of junior high school, and two years of senior high school.

K-12 Curriculum or the Enhanced Basic Education Program is said to be the most significant reform in the country. This program aimed to set the basic education system of the Philippines at par with International standards by providing the learners with the necessary skills and competencies to take on new challenges of the 21st Century (DepEd, 2019). This program seeks to bridge the basic education of the Philippines with, ultimately, employment in the globalized world. Through maximizing the time spent in education to equip the learners with the necessary skills for their chosen career path, and by harnessing the language to improve the way we learn (Ongkiko, 2013).

Despite all the efforts made to improve the quality of the education system, challenges persist. Issues like inadequate resources, overcrowded classrooms, and regional disparities remain significant hurdles. As stated by Mallari, R. (2023) in his article Assessment, Evaluation of K-12 Curriculum, the Second Congressional Commission on Education (EDCOM II) is mandated to conduct a national assessment and evaluation. That is to determine the factors that have contributed to the continuing failure in the performance of identified subject areas to meet the local and international standards. It is in relation to the results of international large-scale assessments such as the 2018 Programme for International Student Assessment (PISA).

The 2018 Programme for International Student Assessment (PISA) revealed that the Philippines scored 353 points in Mathematical Literacy, which was significantly lower than the OECD average of 489 points. The Philippines ranked 78th out of 79 countries in mathematical literacy, with only 19.7% of students meeting the minimum proficiency level (DepEd, 2019). Such statistics underscore the urgent need for reforms and targeted interventions to address the gaps in learning outcomes.

The Department of Education Regional Office III administered the Regional Mid-Year Assessment (RMYA) of K to 12 learners in all public schools in the region last March 13 to 17, 2023. The RMYA was designed to determine the percentage of learners who achieved the minimum level of competency. The most learned and least learned competencies, as well as the cognitive levels of the learners of Region III, were identified. It serves as a baseline data to improve the teaching skills of teachers, and to develop a school intervention/remediation plan for the identified learning gaps in the different learning areas; since the RMYA is one of the priority strategies in the Regional Learning Recovery Plan (DepEd Regional Office III, 2023).

Bongabon Senior High School is one of the participating schools that took the Regional Mid-Year Assessment. As a result, there were only 11.12% of the learners achieved or exceeded the Minimum Proficiency Level in General Mathematics, while 88.88% did not achieve the target Minimum Proficiency Level. Meaning, that 109 out of 976 students passed or met the Minimum Proficiency Level in General Mathematics. These findings signal critical areas for improvement within the educational framework.

Nevertheless, the Philippines continuously strives towards enhancing the quality of education, promoting inclusive access, and aligning education with the demands of a fast-changing world. The Department of Education leads this national effort through the program Sulong EduKalidad. The program aggressively reforms the upskilling of teachers and school leaders through professional development, reviewing and updating the curriculum, continuous improvement of the learning environment, and engaging multi-stakeholder for support and collaboration (DepEd, 2019). However, while systemic reforms are vital, the role of teachers remains paramount. Research indicates that teacher affective support significantly impacts students' academic achievements and emotional well-being. Westphal et al. (2018) highlight that students' achievement emotions are crucial for their academic development, making it essential for teachers to cultivate a supportive classroom environment. Effective teaching transcends mere knowledge transmission; it involves understanding students' emotional needs and fostering motivation (Sakiz, 2007).

In this light, the present study aims to investigate the relationship between perceived classroom environments and student performance in Bongabon Senior High School. By understanding how classroom dynamics influence learning outcomes, this research can contribute valuable insights to educational stakeholders, guiding strategies to enhance teaching practices and ultimately improve student competencies. The findings may also inform ongoing efforts to align the Philippine education system with global standards, thereby addressing the existing educational disparities and empowering future generations.

LITERATURE REVIEW

Successful academic performance in mathematics increased the positive emotions of the students. Moreover, students who received low marks and test results experienced a reduction in good emotions and an increase in negative emotions. As a result, students were locked in a vicious cycle of negative feelings and subpar performance (Pekrun et al., 2017). The study conducted by Carbonaro (2005), states that students with a higher track exert considerably more effort than students on the lower track; these differences in efforts were greatly influenced by prior effort and achievement, as well as students' experiences in class. Similarly, the results of the study of Ajmal & Rafique (2018) revealed that academic achievement and academic self-concept of the distance learner have a strong positive relationship. Where academic effort is a sub-scale of the academic self-concept. Hence, it can be hypothesized that:

H1: Students' academic performance affects students' academic effort.

Teachers' Affective Support

A positive interaction between teacher and student exerts a positive influence on students' engagement and their mathematics performance. An essential part of teacher-student interaction is the emotional support of a teacher, as it plays a significant role in good math performance (Yang et al., 2021). Sakiz, in the year 2007, found that perceived teachers' affective support has a significant positive direct effect on students' academic self-efficacy, academic enjoyment, and perceived sense of belonging. Also, it showed a significant negative direct effect on students' academic hopelessness. Based on the study of Yang et al., (2021), a teacher's emotional support positively affects mathematics performance. Hence, it can be hypothesized that:

H2a: Teachers' affective support affects students' academic performance.
H2b: Teachers' affective support affects students' academic self-efficacy.
H2c: Teachers' affective support affects students' academic hopelessness.
H2d: Teachers' affective support affects students' academic enjoyment.
H2e: Teachers' affective support affects students' perceived sense of belonging.

Academic Enjoyment

One of the important educational constructs is academic enjoyment. As, it will benefit students' engagement, persistence, well-being, and mental health (Basarkod et al., 2023). Enjoyment was defined by Putwain (2018) as a pleasant activating emotion. It is when students are engaged in a joyful, pleasant, and satisfying task. Previous studies such as Mazana et al., (2019); Živković et al., (2023); and Pekrun et al. (2017), found that academic enjoyment was positively correlated with students' mathematics performance. They reiterate that the more the students enjoy doing mathematics the more likely they will engage in problem-solving, enhancing their learning performance. In the study of Sakiz (2007), academic enjoyment directly positively influenced academic effort. Meaning, that students who reported greater academic enjoyment were more likely to report a higher academic effort in mathematics. Meanwhile, Živković et al. (2023) found that academic enjoyment positively correlated to academic self-efficacy. It suggests that achievement emotions and successes in a particular domain of academic performance enhance students' confidence. Hence, it can be hypothesized that:

H3a: Students' academic enjoyment affects students' academic performance.
H3b: Students' academic enjoyment affects students' academic effort.
H3c: Students' academic enjoyment affects students' academic self-efficacy.
H3d: Students' academic enjoyment affects students' academic hopelessness.

Academic Self-Efficacy

Considered an important feature of academic success is academic self-efficacy; the ability of an individual to complete the task successfully (Cebu, 2023). As explained by Garido (2023), self-efficacy is the people's belief in their ability to control their functioning and events that affect their lives, providing the foundation for motivation, well-being, and personal accomplishment. This concept of self-efficacy was first introduced by Albert Bandura (1977) in his Theory of Motivation. In the year 2023, Živković et al. found that academic self-

efficacy can positively predict students' academic performance in mathematics. When you feel competent in doing mathematics tasks can boost your motivation and perseverance resulting in better cognitive and or metacognitive strategies supporting students' achievement. Also, Sakiz (2007) found that perceived academic self-efficacy directly positively predicted students' academic effort in mathematics. It pertains that students with greater academic self-efficacy were more likely to report a higher academic effort in mathematics. Hence, it can be hypothesized that:
H4a: Students' academic self-efficacy affects students' academic performance.
H4b: Students' academic self-efficacy affects students' academic effort.

Perceived Sense of Belonging

Perceived sense of belonging is indeed a complex structure that was rooted in the theory of social interest or the Adlerian Theory (Foix, 1998). From which it emphasizes the person's connectivity to their society. This theory is a holistic approach to overcoming feelings of inferiority and gaining a sense of belonging to achieve success and happiness (Cherry, 2023). As cited in the study of Foix, L. (1998), Adler's social interest theory was summarized by Dreikurs (1971) saying, "Man is a social being. His basic desire is to belong. Only if one feels one belongs can one function, participate, contribute" (p. ix). Sakiz (2007), found that a perceived sense of belonging showed a significant positive direct effect on students' academic self-efficacy and enjoyment. Thus, reported students with a greater sense of belonging tend to have greater academic enjoyment and higher academic self-efficacy in mathematics. Also, a perceived sense of belonging has a significant negative direct impact on academic hopelessness. Hence, it can be hypothesized that:
H5a: Perceived sense of belonging affects students' academic self-efficacy.
H5b: Perceived sense of belonging affects students' academic hopelessness.
H5c: Perceived sense of belonging affects students' academic enjoyment.

Academic Hopelessness

People who generally hold to the belief that "good things" never come their way and that there is nothing they can do to improve certain circumstances, both in schools and in the larger world outside of schools develop academic hopelessness (Au et al, 2009). As cited by Au et al. (2009), Abramson et al. (1989) specifically stated that academic hopelessness refers to the expectation that highly desirable outcomes will not occur or that highly aversive outcomes will occur (negative outcomes). Pekrun et al. (2017), state that students who experienced negative emotions such as anger, anxiety, shame, boredom, and or hopelessness had lower academic achievement in mathematics. Hence, it can be hypothesized that:
H6a: Students' academic hopelessness affects students' academic performance.
H6b: Students' academic hopelessness affects students' academic effort.

This study also investigates the indirect effect of these variables on students' academic effort and students' academic performance. Students' self-efficacy, students' academic performance, and students' academic enjoyment as mediators. A mediator absorbs to some extent the effect of an exogenous variable

on an endogenous variable (Hair, Hult, Ringle, & Sarstedt, 2016). Thus, it is also hypothesized that:
H7a: Students' academic self-efficacy mediates the effects of teachers' affective support on students' academic effort.
H7b: Students' academic self-efficacy mediates the effects of students' academic enjoyment on students' academic effort.
H7c: Students' academic self-efficacy mediates the effects of students' perceived sense of belonging on students' academic effort.
H7d: Students' academic self-efficacy mediates the effects of students' academic enjoyment on students' academic performance.
H7e: Students' academic self-efficacy mediates the effects of students' perceived sense of belonging on students' academic performance.
H7f: Students' academic self-efficacy mediates the effects of teachers' academic support on students' academic performance.
H8a: Students' academic performance mediates the effects of teachers' affective support on students' academic effort.
H8b: Students' academic performance mediates the effects of students' academic self-efficacy on students' academic effort.
H9: Students' academic enjoyment mediates the effects of students' perceived sense of belonging on students' academic effort.

From the identified research hypotheses, Figure 1 presents the proposed research model.

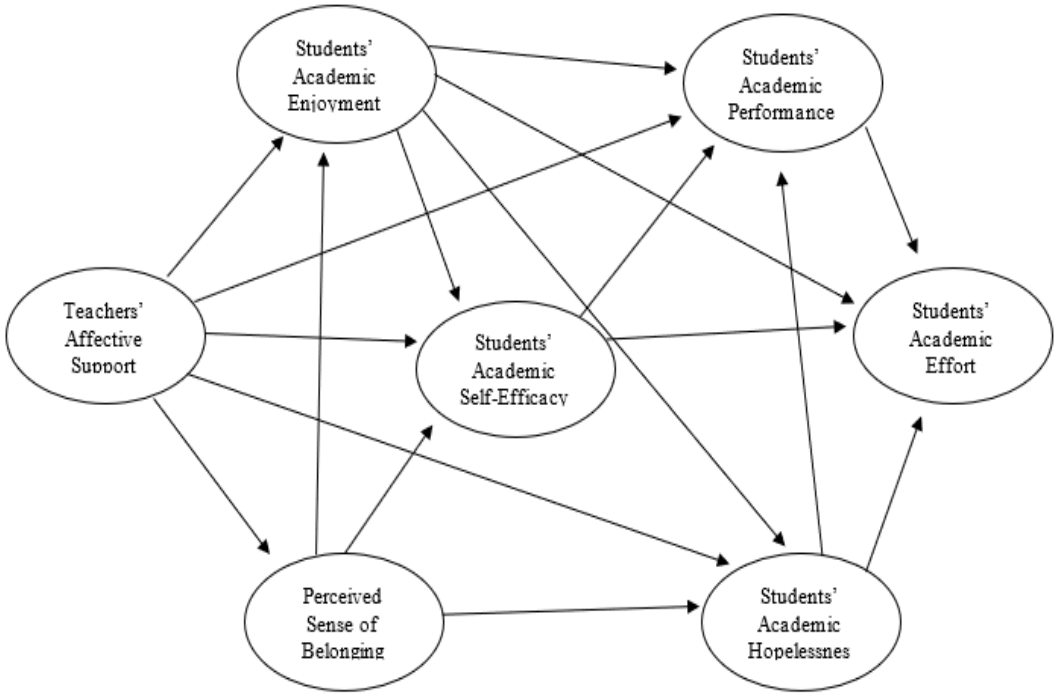

Figure 1. Proposed Structural Research Model

METHODOLOGY

Participants of the Study

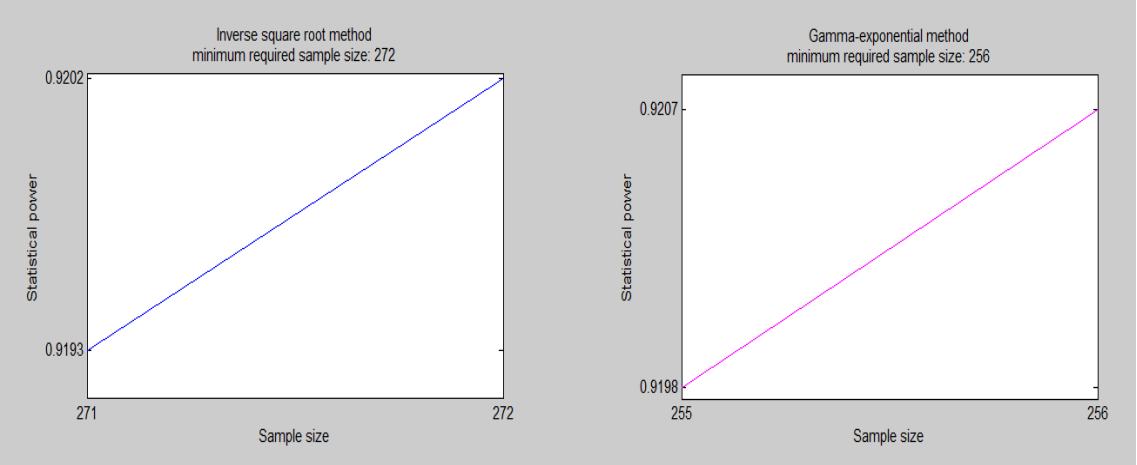

Figure 2. Results of Inverse Square Root and Gamma-Exponential Methods

Figure 2 presents a comparison between the results of the **Inverse** Square Root method (left graph) and the Gamma-Exponential method (right graph) in terms of the relationship between statistical power and sample size. As depicted, both methods demonstrate a linear relationship where statistical power increases with the sample size. However, a notable difference lies in the minimum required sample size to achieve a comparable level of statistical power.

In the Inverse Square Root method, the minimum sample size required to achieve a statistical power of approximately 0.9202 is 272. The graph shows a slight increase in statistical power from 0.9193 at a sample size of 271 to 0.9202 at 272, reflecting a very gradual progression in power as the sample size grows.
In contrast, the Gamma-Exponential method achieves a slightly higher statistical power of 0.9207 with a smaller sample size of 256. As in the Inverse Square Root method, there is a linear increase in power, starting at 0.9198 for a sample size of 255. This result suggests that the Gamma-Exponential method is more efficient, requiring a smaller sample size to reach a comparable or slightly higher level of statistical power than the Inverse Square Root method.

The participants of the present study were 261 students from Bongabon Senior High School; Barangay Sinipit, Bongabon, Nueva Ecija, Philippines. The inverse square root and gamma-exponential methods can be used to estimate sample size sufficiency (Kock & Hadaya, 2018). Using WarpPLS version 7.0, with a minimum absolute significant path coefficient of 0.185, a significance level of 0.05, and a power level of 0.92. The sample size in this study is 261, which is between 256 and 272.

Research Instrument

The proponent reformulated the structural equation model originally proposed by Gonul Sakiz (2007) by incorporating students' academic performance in General Mathematics. For this purpose, the instrument used in Sakiz's dissertation has been adopted, which includes six variables: teachers' affective support (9 items), students' academic enjoyment (6 items), perceived sense of belonging (8 items), students' academic self-efficacy (8 items), students'

academic hopelessness (8 items), and students' academic effort (5 items). However, two items were dropped—one from the teachers' affective support scale and one from the academic enjoyment scale—because they did not meet the required reliability index. Additionally, the proponent intends to use the results of the Regional Mid-Year Assessment in General Mathematics to measure students' academic performance.

Data Analysis

In this study, a predictive-correlational design was employed to explore how various psychological and emotional factors—such as teachers' affective support, students' academic enjoyment, perceived sense of belonging, self-efficacy, and academic hopelessness—impact students' academic effort and academic performance. To analyze these relationships, the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach was used to estimate the parameters of the structural model. PLS-SEM is particularly suited for this type of research, as it allows for the modeling of complex relationships between latent variables and is effective in handling smaller sample sizes or data that may not meet the normality assumptions of covariance-based SEM (Hair, Hult, Ringle, & Sarstedt, 2016).

The data analysis process began with the evaluation of the measurement model, which is critical to ensuring that the constructs used in the model are both valid and reliable. Tests for construct validity (including convergent and discriminant validity) and reliability (using indicators such as Cronbach's alpha and composite reliability) were conducted. These tests confirm that the items used to measure the latent variables—like academic enjoyment, self-efficacy, and hopelessness—accurately represent their intended constructs and that these constructs are consistently measured across the data.

Following the measurement model evaluation, the structural model was assessed. This stage involved examining the path coefficients to understand the strength and direction of the relationships between the variables, as well as calculating the effect sizes to determine the magnitude of these effects. Additionally, collinearity statistics were reviewed to ensure that multicollinearity did not unduly influence the results, and the coefficient of determination (R^2) was examined to assess the proportion of variance in the endogenous variables (students' academic effort and performance) explained by the exogenous variables (e.g., teachers' affective support, self-efficacy). Lastly, the model's predictive relevance was evaluated using the Stone-Geisser's Q^2 statistic, which provides insight into how well the model can predict data not used in model estimation, reinforcing the model's practical value (Hair et al., 2016).

To deepen the analysis, a mediation analysis was conducted to explore the indirect effects of the exogenous variables on academic effort and performance. This analysis investigates whether variables such as students' academic enjoyment, sense of belonging, self-efficacy, and academic hopelessness mediate the relationship between the predictors (e.g., teachers' affective support) and outcomes (e.g., academic effort and performance). Mediation helps to determine the extent to which these mediators absorb or explain the effect of the

independent variables on the dependent variables, shedding light on the complex interplay of emotional, psychological, and academic factors in influencing student outcomes. This step is crucial for identifying the mechanisms through which students' experiences in the classroom and their perceptions of support impact both their effort and academic success.

By employing this comprehensive data analysis approach, the study aims to provide robust insights into how emotional and psychological factors contribute to students' academic outcomes, offering valuable implications for educators and policymakers seeking to improve student performance through targeted interventions.

RESEARCH RESULT

Evaluation of the Measurement Model

In evaluating the measurement model, assessing the validity and reliability of the constructs is crucial. As noted by Meriados and Alcantara (2023), validity refers to the degree to which an instrument accurately measures the concept it is intended to measure, while reliability pertains to the instrument's ability to consistently measure the construct over time (Tavakol & Dennick, 2011).

For validity, both convergent and discriminant validity were evaluated. Convergent validity was assessed using item loadings and average variance extracted (AVE). Each loading's p-value should be less than or equal to .05, and the loadings must have a value of at least 0.50, which signifies sufficient convergent validity (Henseler, Ringle, & Sinkovics, 2009). Table 1 presents the item loadings and AVEs for each latent variable, all of which exceed 0.50, confirming that the constructs—teachers' affective support, students' academic effort, students' academic self-efficacy, students' academic hopelessness, students' academic enjoyment, and students' perceived sense of belonging—meet the accepted standard for convergent validity.

For reliability, both Composite Reliability (CR) and Cronbach's Alpha (CA) were measured to assess internal consistency, ensuring that all items within a construct are measuring the same underlying concept. Both composite reliability and Cronbach's Alpha coefficients should be ≥ 0.70 to be considered acceptable (Hair et al., 2014).

Table 1 shows the CR and CA coefficients for each latent variable, all of which exceed 0.70. Therefore, the constructs of teachers' affective support, students' academic effort, students' academic self-efficacy, students' academic hopelessness, students' academic enjoyment, and students' perceived sense of belonging are considered reliable, demonstrating a high degree of internal consistency.

Table 1. Convergent Validity and Reliability Measures

Construct	No. of items	Item Loading	AVE	CA	CR
Teachers' Affective Support	8	0.613 – 0.780	0.527	0.871	0.899
Academic Effort	5	0.699 – 0.837	0.591	0.825	0.878
Academic Self-Efficacy	8	0.606 – 0.805	0.506	0.858	0.890
Academic Hopelessness	8	0.621 – 0.819	0.550	0.882	0.907
Academic Enjoyment	5	0.699 – 0.807	0.573	0.812	0.870
Perceived Sense of Belongingness	8	0.627 – 0.802	0.533	0.873	0.901

All item loadings are significant at 0.001 ($p<.001$). AVE=average variance extracted; CR=composite reliability; CA=Cronbach's alpha

Table 1 presents the discriminant validity for each latent variable using the Fornell and Larcker criterion, which assesses whether each construct is distinct from the others in the model. Discriminant validity is confirmed when the square root of the Average Variance Extracted (AVE) for each latent construct is greater than any of the correlations involving that construct (Fornell & Larcker, 1981). As Kock (2015) further explains, an instrument demonstrates good discriminant validity if the value in the diagonal cell of each column is higher than any of the other numbers in the same column.

In this case, Table 2 shows that the square root of the AVE for each latent variable—such as teachers' affective support, students' academic effort, students' academic self-efficacy, students' academic hopelessness, students' academic enjoyment, and students' perceived sense of belonging—is greater than its respective correlations with other constructs. This confirms that the constructs in the study are unique and measure distinct concepts, fulfilling the requirements for discriminant validity. This ensures that the constructs are valid for use in further analyses within the structural equation modeling.

Table 2. Discriminant Validity using Fornell and Larcker Criterion

	TAS	AEf	ASE	AH	AEn	PSB
Teachers' Affective Support	**(0.726)**					
Academic Effort	0.397	**(0.769)**				
Academic Self-Efficacy	0.399	0.645	**(0.711)**			
Academic Hopelessness	0.038	0.062	0.107	**(0.741)**		
Academic Enjoyment	0.304	0.376	0.495	0.245	**(0.757)**	
Perceived Sense of Belongingness	0.532	0.524	0.599	0.174	0.650	**(0.730)**

Diagonal elements are the square root of the AVE of constructs, whereas the off-diagonal elements are the correlation between constructs.

Evaluation of the Structural Model

The evaluation of the structural model encompasses several key components, including the assessment of path coefficients, effect sizes, the coefficient of determination (R^2), and predictive relevance (Q^2). Figure 3 illustrates the standardized path coefficients and residual variances for the

variables within the hypothesized structural model. The beta coefficient (β) serves as the path coefficient in this model.

Notably, several relationships are positively significant: the path between teachers' affective support and students' academic self-efficacy (β = 0.114, p = 0.031), teachers' affective support and students' perceived sense of belonging (β = 0.544, p < 0.001), students' academic enjoyment and students' academic self-efficacy (β = 0.206, p < 0.001), students' academic enjoyment and students' academic hopelessness (β = 0.258, p < 0.001), students' academic enjoyment and students' academic effort (β = 0.113, p = 0.032), students' perceived sense of belonging and students' academic enjoyment (β = 0.686, p < 0.001), students' perceived sense of belonging and students' academic self-efficacy (β = 0.412, p < 0.001), students' academic self-efficacy and students' academic performance (β = 0.202, p < 0.001), students' academic self-efficacy and students' academic effort (β = 0.593, p < 0.001), and students' academic performance and students' academic effort (β = 0.105, p = 0.043).

Conversely, some relationships are negatively significant, specifically between teachers' affective support and students' academic performance (β = -0.185, p = 0.001), as well as between teachers' affective support and students' academic hopelessness (β = -0.212, p < 0.001).

Furthermore, the following relationships did not achieve statistical significance: the path between teachers' affective support and students' academic enjoyment (β = 0.049, p = 0.216), students' academic enjoyment and students' academic performance (β = 0.086, p = 0.081), students' perceived sense of belonging and students' academic hopelessness (β = 0.023, p = 0.352), students' academic hopelessness and students' academic performance (β = 0.089, p = 0.073), and students' academic hopelessness and students' academic effort (β = 0.037, p = 0.277).

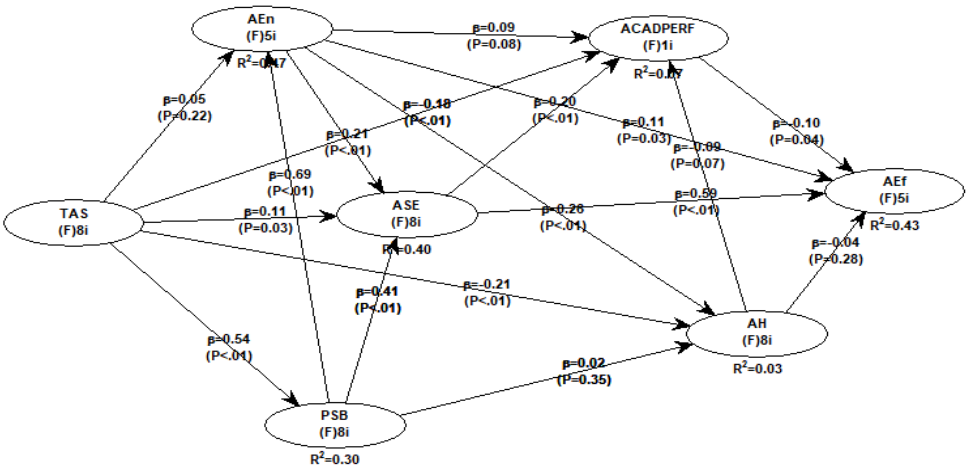

Figure 3. Standardized Path Coefficients and Residual Variances of the Variables in the Hypothesized Structural Model

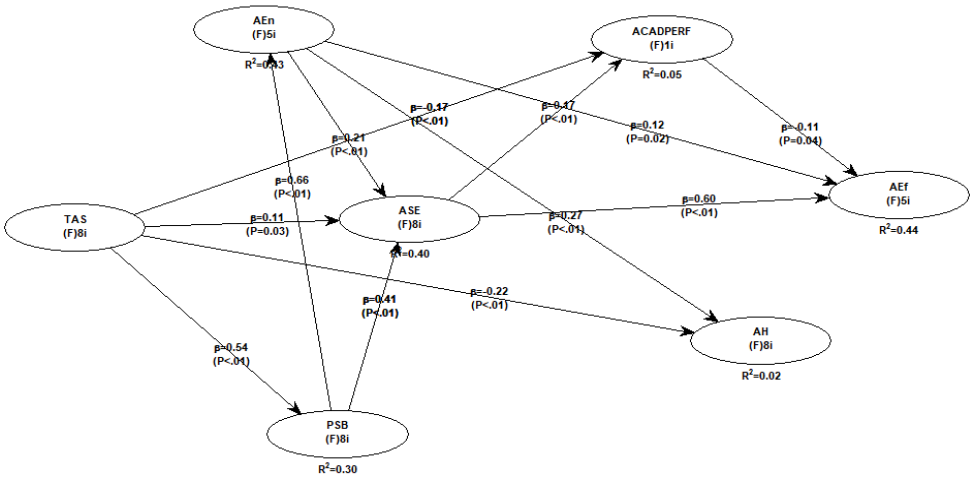

Figure 4. Standardized Path Coefficients and Residual Variances in the Reduced Model

Table 3 presents the direct and indirect effects from the PLS path model analysis. The results reveal that students' academic performance negatively affects academic effort (β = -0.105, p = 0.043) with a small effect size (Cohen's f^2 = 0.005), supporting H1. Teachers' affective support (TAS) significantly and negatively impacts students' academic performance (β = -0.185, p = 0.001) with a medium effect size (f^2 = 0.028), supporting H2a. However, TAS positively affects students' academic self-efficacy (ASE) (β = 0.114, p = 0.031) with a large effect size (f^2 = 0.047), supporting H2b, and also negatively impacts academic hopelessness (AH) (β = -0.212, p < 0.001) with a large effect size (f^2 = 0.051), supporting H2c. On the other hand, TAS does not significantly affect students' academic enjoyment (AEn) (β = 0.049, p = 0.216), thus H2d is not supported. TAS has a strong positive effect on students' perceived sense of belonging (PSB) (β = 0.544, p < 0.001) with a medium-to-large effect size (f^2 = 0.296), supporting H2e.

The findings further indicate that students' academic enjoyment does not significantly affect academic performance (β = 0.086, p = 0.081), hence H3a is not supported. However, academic enjoyment significantly and positively influences academic effort (β = 0.113, p = 0.032) with a small effect size (f^2 = 0.046), as well as academic self-efficacy (β = 0.206, p < 0.001) with a medium effect size (f^2 = 0.105), and academic hopelessness (β = 0.258, p < 0.001) with a small effect size (f^2 = 0.073), supporting H3b, H3c, and H3d. Academic self-efficacy positively affects both academic performance (β = 0.202, p < 0.001) with a small effect size (f^2 = 0.031) and academic effort (β = 0.593, p < 0.001) with a large effect size (f^2 = 0.384), supporting H4a and H4b.

Regarding perceived sense of belonging (PSB), it does not significantly affect academic hopelessness (β = 0.023, p = 0.352), thus H5b is not supported. However, PSB positively impacts both academic self-efficacy (β = 0.412, p < 0.001) with a medium-to-large effect size (f^2 = 0.251) and academic enjoyment (β = 0.686, p < 0.001) with a large effect size (f^2 = 0.452), supporting H5a and H5c. Lastly, academic hopelessness does not significantly affect either academic performance (β = -0.089, p = 0.073) or academic effort (β = -0.037, p = 0.277), so H6a and H6b are not supported.

The analysis also examines indirect effects. Students' academic enjoyment significantly and positively affects academic effort through the mediating role of self-efficacy (β = 0.123, p = 0.002), supporting H7a. However, academic enjoyment does not significantly impact academic performance through self-efficacy (β = 0.036, p = 0.205), so H7b is not supported. Additionally, teachers' affective support and perceived sense of belonging positively influence academic effort through academic performance (β = 0.019, p = 0.329) and academic enjoyment (β = 0.077, p = 0.037), respectively, supporting H8 and H9.

Table 3. Direct and Indirect Effects

	B	**SE**	**p-value**	f^2	***Findings***
Direct Effect					
H1. AcadPerf → AEf	-0.105	0.061	0.043	0.005	Supported
H2a. TAS → AcadPerf	-0.185	0.060	0.001	0.028	Supported
H2b. TAS → ASE	0.114	0.061	0.031	0.047	Supported
H2c. TAS → AH	-0.212	0.060	<0.001	0.051	Supported
H2d. TAS → AEn	0.049	0.062	0.216	0.016	Not Supported
H2e. TAS → PSB	0.544	0.057	<0.001	0.296	Supported
H3a. AEn → AcadPerf	0.086	0.061	0.081	0.007	Not Supported
H3b. AEn → AEf	0.113	0.061	0.032	0.046	Supported
H3c. AEn → ASE	0.206	0.060	<0.001	0.105	Supported
H3d. AEn → AH	0.258	0.059	<0.001	0.073	Supported
H4a. ASE → AcadPerf	0.202	0.060	<0.001	0.031	Supported
H4b. ASE → AEf	0.593	0.056	<0.001	0.384	Supported
H5a. PSB → ASE	0.412	0.058	<0.001	0.251	Supported
H5b. PSB →AH	0.023	0.062	0.352	0.006	Not Supported
H5c. PSB → AEn	0.686	0.055	<0.001	0.452	Supported
H6a. AH → AcadPerf	-0.089	0.061	0.073	0.006	Not Supported
H6b. AH → AEf	-0.037	0.062	0.277	0.008	Not Supported
Indirect effect					
H7a. AEn → ASE →AEf	0.123	0.043	0.002	0.050	Supported
H7b. AEn → ASE → AcadPerf	0.036	0.044	0.205	0.001	Not Supported
H8. TAS → AcadPerf → AEf	0.019	0.044	0.329	0.008	Not Supported
H9. PSB → AEn → AEf	0.077	0.043	0.037	0.041	Supported

Legend: AcadPerf = RMYA General Mathematics Scores; TAS = Teachers' Affective Support; AEn = Students' Academic Enjoyment; ASE = Students' Academic Self-Efficacy; PSB = Students' Perceived Sense of Belonging; AH = Students' Academic Hopelessness; AEf = Students' Academic Effort; f^2 is Cohen's(1988) effect size: 0.02=small, 0.15=medium, and 0.35=large.

The assessment of full collinearity is a crucial part of evaluating the structural model, as it addresses both vertical and lateral collinearity issues. Full collinearity is tested using variance inflation factors (VIFs), with threshold values typically set at 10, 5, and 3.3. A VIF value equal to or above these thresholds indicates potential collinearity among the variables (Kock & Lynn, 2012). Table 4 provides the VIFs for the variables in this study, showing that the values for students' academic performance, teachers' affective support, academic effort, self-efficacy, academic hopelessness, academic enjoyment, and perceived sense

of belonging range from 1.054 to 2.54. All are below the threshold of 3.3, indicating no issues with collinearity and that the model is free from common method bias, with no vertical or lateral collinearity detected.

Table 4 also displays the coefficients of determination (R^2) and predictive relevance (Q^2) for the variables. R^2 measures the proportion of variance explained by the predictor variables (Ringle et al., 2014). According to Cohen (1988), R^2 values of 2%, 13%, and 26% are classified as small, medium, and large effects, respectively. The results show that R^2 values for academic effort, self-efficacy, academic enjoyment, and perceived sense of belonging are large, while those for academic performance and academic hopelessness are small.

The Q^2 coefficient indicates the predictive accuracy of the PLS path model, where values greater than zero suggest meaningful predictive relevance (Hair et al., 2014). A Q^2 value of one would indicate a perfect model with no errors (Ringle et al., 2014). Table 4 shows that all Q^2 values are greater than zero, with values for academic performance (0.085), academic effort (0.444), self-efficacy (0.410), academic hopelessness (0.132), academic enjoyment (0.436), and perceived sense of belonging (0.297) demonstrating significant predictive accuracy.

Table 4. Collinearity Assessment, Coefficient of Determination, and Predictive Relevance

Constructs	Full Collinearity VIF	R^2	Q^2
Academic Performance	1.054	0.072	0.085
Teachers' Affective Support	1.491		
Academic Effort	1.853	0.427	0.444
Academic Self-Efficacy	2.159	0.403	0.410
Academic Hopelessness	1.070	0.028	0.132
Academic Enjoyment	1.856	0.469	0.436
Perceived Sense of Belonging	2.545	0.296	0.297

DISCUSSION

The findings of the present study both align with and contradict previously published research, offering new insights into the complex relationships between students' academic performance, effort, and various emotional and cognitive factors in the context of mathematics education.

Starting with the negative relationship between academic performance and academic effort, our results challenge earlier studies, such as Ajmal and Rafique (2018), which found a strong positive correlation between academic achievement and effort. The contradiction may lie in the context-specific nature of academic motivation. While prior studies suggest that high achievers tend to exert more effort, the present study indicates that lower-performing students may compensate for poor performance by putting in more effort. This finding can be interpreted as a form of academic resilience, where students who struggle academically increase their effort in an attempt to overcome challenges, which may not be fully accounted for in studies like Pekrun et al. (2017) and Carbonaro (2005), which focus more on the emotional toll of poor performance rather than the compensatory behaviors it might inspire.

Similarly, the results concerning teachers' affective support stand in contrast to previous studies that emphasize its positive role in academic performance. For instance, Sakiz (2007) and Yang et al. (2021) emphasize the crucial role of emotional support in fostering a positive learning environment, which in turn promotes academic achievement. However, the negative effect of affective support on academic performance in this study suggests that too much emotional support may unintentionally reduce students' independence and problem-solving abilities, which are essential in subjects like mathematics. This supports the argument that while emotional support is crucial, promoting student autonomy is equally important for academic success in math. The dual role of affective support—positively influencing students' self-efficacy and sense of belonging while negatively affecting performance—highlights the nuanced impact of teacher-student interactions.

On the other hand, the findings regarding academic enjoyment, self-efficacy, and effort align with previous studies. Like Sakiz (2007) and Živković et al. (2023), this study confirms that students who enjoy math are more likely to put in effort, believe in their abilities, and avoid feelings of hopelessness. This connection between academic enjoyment and effort, supported by self-efficacy, underscores the motivational power of positive emotions in learning. However, we did not find strong evidence to support the idea that academic enjoyment directly influences academic performance, contradicting studies such as those by Mazana et al. (2019) and Pekrun et al. (2017), which emphasize the link between positive emotions and academic success. The lack of a direct effect in our study suggests that while enjoyment boosts motivation and effort, other factors—such as cognitive ability and instructional quality—might have a more immediate impact on performance.

The study also provides valuable insights into the role of self-efficacy, reinforcing findings by Živković et al. (2023) and Sakiz (2007) that students' belief in their abilities significantly affects both academic effort and performance. The positive relationship between self-efficacy and performance is well-established in educational psychology, as learners who believe in their competence are more likely to engage in challenging tasks and persist through difficulties. The findings strengthen this body of research, further suggesting that self-efficacy is a critical mediator between emotional factors, such as enjoyment, and academic behaviors, such as effort.

Moreover, the influence of a perceived sense of belonging on academic self-efficacy and enjoyment resonates with Adler's social theory, which emphasizes the importance of social acceptance in fostering motivation and engagement. This finding aligns with Sakiz (2007), who also reported that a sense of belonging positively influences self-efficacy and enjoyment. However, our study diverges from Sakiz's work by finding no significant impact of belonging on academic hopelessness. This suggests that while a sense of belonging enhances positive emotions and confidence, it may not be sufficient to alleviate feelings of hopelessness, which could be more deeply rooted in individual or contextual factors, such as prior academic experiences or external pressures.

Finally, the study's findings on the mediating role of self-efficacy in the relationship between academic enjoyment and effort further extend the literature on motivational psychology. While the indirect effect of academic enjoyment on performance was not statistically significant, the finding that self-efficacy strengthens the link between enjoyment and effort supports the argument that self-belief is a key driver of academic persistence. This nuanced understanding of the role of self-efficacy can inform interventions aimed at boosting student motivation, suggesting that fostering both enjoyment and self-efficacy may lead to greater academic effort, even if not immediately reflected in performance outcomes.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the present study, several conclusions can be drawn regarding the dynamics of students' academic performance, effort, and the emotional and cognitive factors influencing them. First, the negative relationship between students' academic performance and academic effort suggests that lower-performing students tend to increase their effort in response to poor results, which may reflect resilience and a determination to improve. This challenges the commonly accepted notion of a positive correlation between academic achievement and effort, highlighting the importance of supporting struggling students without assuming a uniform motivational response.

Second, teachers' affective support plays a dual role: while it enhances students' self-efficacy and sense of belonging, it may not always lead to improved academic performance. This indicates that while emotional support is crucial for fostering a positive learning environment, it should be balanced with opportunities for student independence to ensure academic success, particularly in subjects like mathematics that require problem-solving and critical thinking.

Third, the study reinforces the importance of academic enjoyment and self-efficacy in driving students' effort, confirming that when students enjoy learning and believe in their abilities, they are more likely to engage persistently with challenging tasks. However, the lack of a direct effect of academic enjoyment on performance suggests that other factors, such as instructional methods or external academic pressures, may play a more immediate role in determining academic outcomes.

Based on these conclusions, several recommendations can be made. Teachers should focus on balancing emotional support with strategies that promote student autonomy and problem-solving skills, especially in subjects like math. Additionally, fostering academic enjoyment and self-efficacy should be central to instructional design, as these factors significantly influence student effort. Schools could implement programs that enhance students' sense of belonging and self-efficacy, such as peer support groups or mentorship programs, to create a more inclusive and motivating learning environment. Finally, further research is recommended to explore the mediating roles of self-efficacy and autonomy in the relationship between emotional support, academic enjoyment, and performance, particularly in different academic contexts.

ADVANCED RESEARCH

While the predictive accuracy of the PLS path model on teachers' affective support and interplays of different variables that influence students' academic effort and academic performance is meaningful, the proponent believes that exploring additional mediating factors, such as intrinsic motivation or engagement strategies, could enhance understanding of the relationship between students' academic enjoyment and their academic effort and performance. Longitudinal studies would provide insights into the long-term effects of teachers' affective support, students' academic self-efficacy, and perceived sense of belonging on academic outcomes. Expanding research to diverse educational contexts, including varying cultural and socio-economic backgrounds, would help determine how these factors vary across populations. Implementing and evaluating targeted interventions aimed at enhancing students' sense of belonging and self-efficacy could yield valuable insights into effective teaching practices. Additionally, comparative studies between different subjects could clarify whether the observed relationships hold across various academic domains. Finally, investigating emotional factors, such as anxiety related to mathematics, could provide a more comprehensive understanding of how emotional well-being influences academic effort and performance. Pursuing these avenues will deepen knowledge of the dynamics in educational settings and inform strategies to support student success.

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