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The Moderating Influence of Perceived Teachers' Effectiveness on the Mathematical Performance of Economically Diverse Students

Jocelyn N. Orogo[1], Anna Loretta C. Romulo[2]

[1]Teacher V, Department of Education, Division of Camarines Sur, Pasacao District, Juan F. Triviño Memorial High School, Caranan, Pasacao, Camarines Sur, Philippines
[2]Dean, College of Computer Studies, Naga College Foundation, Inc., Naga City, Camarines Sur, Philippines

Abstract

This study examined the moderating influence of perceived teachers' effectiveness on the mathematical performance of economically diverse Grade 11 students in selected public senior high schools in the Division of Camarines Sur during the first semester of School Year 2025–2026. The research was grounded on the premise that instructional quality, as perceived by students, may influence academic outcomes and potentially moderate the effects of socio-economic differences on mathematics achievement. A descriptive–correlational research design was employed involving 699 Grade 11 students selected through stratified random sampling from five public senior high schools representing the five congressional districts of Camarines Sur. Data were gathered using a validated researcher-made questionnaire measuring perceived teachers' effectiveness in terms of learning objectives, learning content, learning activities, and learning assessment, while students' academic performance was determined through their first semester General Weighted Average (GWA) in mathematics. Descriptive statistics, Pearson correlation, multiple linear regression, and General Linear Model were used to analyze the data. Results revealed that perceived teachers' effectiveness was rated high overall. A significant relationship was found between perceived teachers' effectiveness and students' mathematical performance. Among student profile variables, gender emerged as a significant predictor of mathematics achievement, while age and socio-economic status did not significantly predict performance. Furthermore, perceived teachers' effectiveness significantly predicted mathematics grades across different income levels, indicating that effective instructional practices play a crucial role in supporting students' academic success regardless of economic background. The findings highlight the importance of strengthening instructional effectiveness to promote equitable mathematics achievement among economically diverse learners.

Keywords: Teachers' Effectiveness, Students' Academic Performance, Socio-Economic Status, Instructional Quality

INTRODUCTION

The sustained quality of mathematics education depends largely on the effectiveness of teachers who guide learners in developing logical reasoning, analytical thinking, and problem-solving skills necessary for

academic and professional success. However, disparities in students' academic performance continue to persist, particularly among learners from economically diverse backgrounds. Differences in access to learning resources, parental support, and educational opportunities often shape how students engage with mathematical concepts and ultimately influence their academic outcomes. Studies emphasize that instructional quality, teacher competence, and supportive classroom environments significantly contribute to improving students' mathematics achievement and engagement (Yılmaz et al., 2025; Wijaya et al., 2024; Song et al., 2025; Sinaga et al., 2025). Consequently, strengthening instructional effectiveness and understanding how teaching practices influence learning outcomes have become critical priorities in mathematics education across diverse socio-economic contexts.

At the global level, improving educational quality and equity is strongly emphasized in international policy frameworks. The United Nations' Sustainable Development Goals (SDGs), particularly SDG 4, call for ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all (United Nations, 2015). Complementing this global vision, international organizations such as UNESCO and the Organisation for Economic Co-operation and Development (OECD) highlight teacher quality as one of the most influential in-school factors affecting student achievement. Effective teachers are expected to demonstrate pedagogical competence, clear instructional delivery, responsive assessment practices, and the ability to create inclusive learning environments that accommodate diverse learners (UNESCO, 2024; OECD, 2023). When teachers exhibit these qualities, students are more likely to develop deeper conceptual understanding, stronger academic motivation, and improved mathematical performance.

These global concerns are also evident in the Philippine educational context, where improving mathematics learning outcomes remains a continuing priority. Public school classrooms often accommodate learners from varied socio-economic backgrounds, creating challenges in providing equitable learning opportunities. National policy frameworks emphasize strengthening teacher competence and instructional effectiveness as key strategies for addressing learning disparities. For instance, the MATATAG Agenda articulated in DepEd Order No. 35, s. 2022 prioritizes quality teaching, learning recovery, and foundational skill development to improve educational outcomes. Similarly, the Philippine Development Plan 2023–2028 underscores the importance of enhancing teacher quality and addressing learning gaps, particularly in STEM disciplines. These initiatives highlight the central role of teachers in promoting equitable academic achievement among diverse learners.

Within this context, perceived teachers' effectiveness has emerged as an important factor influencing students' academic performance in mathematics. Effective teaching practices—characterized by clear learning objectives, organized content delivery, engaging learning activities, and meaningful assessment—can enhance students' understanding of mathematical concepts and foster sustained academic engagement. Research indicates that when students perceive their teachers as competent, supportive, and responsive to their learning needs, they demonstrate stronger motivation and higher academic achievement (Borah et al., 2024; Egara et al., 2024; Vieriu & Petrea, 2025). Conversely, when instructional practices are perceived as ineffective, existing disparities related to socio-economic status may become more pronounced, potentially widening achievement gaps among learners.

Socio-economic status also plays a critical role in shaping students' academic outcomes, particularly in subjects requiring sustained cognitive engagement such as mathematics. Students from economically disadvantaged backgrounds may encounter limitations in access to learning resources, supplementary instruction, and supportive academic environments, which can affect their performance. Nevertheless,

evidence suggests that effective teaching practices can help mitigate these disparities by providing structured guidance, meaningful learning experiences, and supportive classroom environments (Yılmaz et al., 2025; Song et al., 2025). In this regard, perceived teachers' effectiveness may function as a moderating factor that influences how socio-economic conditions translate into academic performance.

Given these considerations, examining the moderating influence of perceived teachers' effectiveness on students' mathematical performance becomes essential for understanding how instructional practices interact with socio-economic contexts in shaping learning outcomes. Generating empirical evidence on this relationship is particularly important in public senior high schools where students come from diverse economic backgrounds and where instructional quality plays a crucial role in promoting equitable academic achievement. Accordingly, the present study investigates how perceived teachers' effectiveness influences the mathematical performance of economically diverse Grade 11 students in selected public senior high schools in the Division of Camarines Sur.

Research Objectives

This study determined the moderating influence of perceived teachers' effectiveness on the mathematical performance of economically diverse Grade 11 students in selected senior high schools in the Division of Camarines Sur during the first semester of School Year 2025–2026. Specifically, the following objectives were attained: (1) the profile of the students in terms of age, gender, and socio-economic status; (2) the level of perceived teachers' effectiveness in teaching Mathematics in terms of learning objectives, learning content, learning activities, and learning assessment; (3) the level of students' academic performance in Mathematics based on their first semester General Weighted Average (GWA); (4) the significant relationship between perceived teachers' effectiveness in teaching Mathematics and students' academic performance; (5) the significant predictors of mathematics achievement among student profile variables such as age, gender, and socio-economic status; (6) the extent to which socio-economic status moderates the relationship between perceived teachers' effectiveness and students' mathematical performance; and (7) the school program developed to strengthen teaching effectiveness and improve students' academic performance based on the findings of the study.

METHODOLOGY

This study employed the descriptive–correlational research method. The descriptive method was applied because it allowed for a systematic and detailed description of the characteristics and conditions of the respondents without manipulating any variables, thereby providing a clear understanding of the phenomenon being investigated (Mills & Gay, 2018). In this study, the descriptive approach was utilized to determine the profile of the Grade 11 students in terms of age, gender, and socio-economic status. It was also employed to assess the level of perceived teachers' effectiveness in teaching Mathematics in terms of learning objectives, learning content, learning activities, and learning assessment. Similarly, the descriptive method was applied to determine the level of students' academic performance in Mathematics, which was measured using their first semester General Weighted Average (GWA).

The correlational method was employed because it enabled the identification and quantification of relationships among variables, indicating how variations in one variable correspond with changes in another without implying causation (Mills & Gay, 2018). In the present study, this method was utilized to determine the significant relationship between perceived teachers' effectiveness and students' academic performance in Mathematics. Furthermore, the correlational approach was applied to examine the

predictive influence of student profile variables such as age, gender, and socio-economic status on mathematics achievement through Multiple Linear Regression (MLR). This statistical method enabled the researcher to estimate the relative contribution of each predictor variable in explaining variations in students' academic performance (Hair et al., 2022; Montgomery, Peck, & Vining, 2021).

Moreover, the study examined the moderating influence of socio-economic status on the relationship between perceived teachers' effectiveness and students' mathematical performance through the General Linear Model (GLM). The GLM allowed the researcher to analyze interaction effects between teacher effectiveness and socio-economic status, determining whether the strength or direction of the relationship between instructional effectiveness and mathematics performance varied across economically diverse groups (Hayes, 2022; Tabachnick & Fidell, 2019). The use of GLM is widely recommended in educational research for testing moderation effects and examining group-based differences in academic outcomes (Field, 2022; Hayes, 2022).

Additionally, the Pearson Product–Moment Correlation Coefficient (r) was utilized to determine the strength and direction of the relationship between perceived teachers' effectiveness and students' academic performance. Pearson correlation is appropriate when examining linear relationships between continuous variables in educational research contexts (Field, 2018; Pallant, 2020; Turney, 2024). To provide a more comprehensive interpretation of the findings, effect size measures were computed to determine the magnitude of the relationships observed in the study.

Furthermore, a 4-point Likert Scale was employed to measure the level of perceived teachers' effectiveness in teaching Mathematics, with response categories interpreted as follows:

Weight	Scale Interval	Interpretation
4	3.26 – 4.00	Very High (VH)
3	2.51 – 3.25	Fairly High (FH)
2	1.76 – 2.50	Fairly Low (FL)
1	1.00 – 1.75	Very Low (VL)

The instrument used in the study was a researcher-made questionnaire, which was developed based on relevant literature on instructional effectiveness, socio-economic influences, and mathematics achievement. Researcher-developed questionnaires are appropriate when the instrument needs to be tailored to the specific objectives and context of the study (Creswell & Creswell, 2018). The instrument underwent expert validation and reliability testing, and the reliability analysis yielded a Cronbach's alpha coefficient of 0.810, indicating very good internal consistency (Robertson & Evans, 2020).

The respondents of the study consisted of 699 Grade 11 students enrolled in General Mathematics from five selected public senior high schools in the Division of Camarines Sur during the first semester of School Year 2025–2026. The respondents were selected through stratified random sampling to ensure proportional representation across socio-economic groups and school districts. Stratified sampling was employed because it allows researchers to obtain representative samples from different subgroups within the population, thereby increasing the reliability and generalizability of the findings (Etikan et al., 2015; Creswell & Creswell, 2018).

Finally, the findings of the study served as the empirical basis for developing a school-based instructional support program aimed at strengthening teachers' effectiveness and improving students' mathematics

performance. The development of the proposed program followed a modified ADDIE model, specifically the Analysis, Design, and Development phases, to ensure that the program was systematically derived from the research findings and aligned with evidence-based educational program planning (Biech, 2017; Branch, 2020).

RESULTS AND DISCUSSION

Distribution of respondents of the study. Table 1 presents the distribution of the respondents according to the selected public senior high schools in the five congressional districts of the Division of Camarines Sur. Out of the total population of 1,007 Grade 11 students enrolled in General Mathematics, a total of 699 students participated in the study. The respondents were drawn from five schools representing the five congressional districts to ensure geographical representation and contextual diversity within the division. Among the participating schools, School D recorded the highest number of respondents with 175 students (25.04%), followed by School B with 153 respondents (21.89%), School E with 139 respondents (19.89%), School C with 123 respondents (17.60%), and School A with 109 respondents (15.59%). The distribution of respondents reflects proportional representation from each selected school, allowing the study to capture variations in learning environments and socio-economic contexts across the different districts.

Table 1 Distribution of Respondents

School	N	n	%
School A	165	109	15.59
School B	190	153	21.89
School C	140	123	17.60
School D	301	175	25.04
School E	211	139	19.89
Total	1007	699	100

The use of stratified random sampling ensured that students from different socio-economic groups were adequately represented in the study. By selecting one school from each congressional district and proportionately including students within each school, the sampling procedure strengthened the representativeness of the sample and minimized sampling bias. This approach is particularly appropriate when researchers aim to analyze relationships across different subgroups within a population (Etikan et al., 2015; Creswell, 2018).

Furthermore, the inclusion of respondents from multiple schools allowed the study to account for variations in instructional contexts, school resources, and student demographics that may influence academic performance in mathematics. Previous research has emphasized that school-level contexts and instructional environments can affect students' engagement and achievement in mathematics (Darling-Hammond et al., 2017; Kraft et al., 2018). By incorporating students from different districts and schools, the study was able to examine the moderating influence of perceived teachers' effectiveness across economically diverse learning environments.

Overall, the distribution of respondents across the five selected schools provides a balanced and representative sample of Grade 11 students in the Division of Camarines Sur. This sampling structure strengthens the validity of the findings and supports the generalizability of the results regarding the

relationship between perceived teachers' effectiveness and students' mathematical performance among economically diverse learners.

Profile of the Students along Age

Age**.** Table 2A presents the profile of the respondents according to age. The distribution shows that the majority of the 699 Grade 11 students were 16 years old, comprising 475 students (67.95%). This was followed by 17-year-old students with 172 respondents (24.60%). A smaller proportion consisted of 18-year-old students with 30 respondents (4.29%), while 17 respondents (2.43%) were aged 19 and above, and 5 respondents (0.72%) were 15 years old.

Table 2A Profile of the Students along Age

Age (in years)	f	Percentage
15	5	0.72
16	475	67.95
17	172	24.60
18	30	4.29
19 and above	17	2.43
Total	699	100

The results indicate that most respondents fall within the typical age range for Grade 11 learners, suggesting a relatively homogeneous group in terms of developmental stage. Such uniformity minimizes age-related variability in mathematical learning and allows clearer examination of the relationship between perceived teachers' effectiveness and students' academic performance. These findings align with studies emphasizing that demographic characteristics, including age and socio-economic context, influence learning readiness and academic engagement (Estipona & Santos, 2025; Khaiwal & Gupta, 2025). Similarly, research by Pahilan and Comahig (2025) showed that peer collaboration and cognitive readiness significantly influence academic outcomes among senior high school learners. Furthermore, Gooden et al. (2025) highlighted that equitable instructional environments can mitigate demographic differences in academic performance. Likewise, Fundal and Fuentebilla (2025) reported that differentiated instruction improves conceptual understanding across diverse learner groups.

From a theoretical perspective, these findings support Constructivist Learning Theory, which posits that learners construct knowledge through guided experiences appropriate to their cognitive stage (Piaget; Vygotsky). When students belong to similar developmental levels, instructional effectiveness becomes a stronger determinant of learning outcomes (Kurt, 2021). This perspective is also consistent with the Instructional Teaching Support in Mathematics Education (ITSME) Theory, which proposes that perceived teacher effectiveness moderates the relationship between socio-economic background and mathematical performance.

Gender

Gender. Table 2B presents the distribution of respondents according to gender. Out of 699 Grade 11 students, 411 (58.8%) were female while 288 (41.2%) were male, indicating a higher proportion of female students in the sample.

Table 2B Profile of the Students along Gender

Gender	f	Percentage
Male	288	41.2
Female	411	58.8
Total	699	100

The findings show that female students constitute the majority of the respondents. Despite this imbalance, both genders remain adequately represented, allowing meaningful comparison in relation to mathematical performance and perceived teacher effectiveness. These results are consistent with studies indicating that female students often demonstrate higher engagement and persistence in structured learning environments (Yi et al., 2024; Balaquiao, 2024). Similarly, Song, Mak, and Chen (2025) reported that female learners tend to exhibit stronger conceptual engagement in mathematics learning. Research by Abalde and Oco (2023) further emphasized that structured study habits commonly observed among female students positively influence academic performance. Likewise, Marbella and Cruz (2025) highlighted that interactive teaching approaches enhance engagement particularly among female learners.

From a theoretical standpoint, these findings are supported by Constructivist Learning Theory, which emphasizes that learning is shaped by active engagement and social interaction (Kurt, 2021). In addition, Achievement Goal Theory suggests that students who demonstrate higher engagement and persistence are more likely to adopt mastery-oriented learning goals associated with improved academic outcomes (Huang, 2019). The TPACK Framework further emphasizes that effective instruction arises from the integration of pedagogy and content knowledge (Mishra & Koehler, 2006), which can influence students' perceptions of teaching effectiveness and academic performance.

Socio-Economic Status

Socio-Economic Status. Table 2C presents the socio-economic profile of the respondents.

Table 2C Profile of the Students along Socio-Economic Status

Socio-Economic Status	f	Percentage
Low income	449	64.23
Lower-middle income	130	18.60
Middle income	91	13.02
Upper-middle income	15	2.15
High income	14	2.00
Total	699	100

The results reveal that the majority of students come from low-income households, representing 64.23% of the sample. Only a small proportion belongs to upper-middle and high-income groups. These findings suggest that many learners may face financial limitations affecting access to educational resources and academic support. Previous studies have demonstrated that socio-economic conditions significantly influence students' academic outcomes (Estipona & Santos, 2025; Portillo & Alvarado, 2025). Similarly,

Vieriu and Petrea (2025) found that students from higher socio-economic backgrounds often benefit from greater academic support and learning resources. However, Song et al. (2025) emphasized that effective teaching practices can mitigate socio-economic disparities by providing structured and responsive instruction. Likewise, Yi et al. (2024) reported that targeted instructional support can help bridge learning gaps among students from economically disadvantaged backgrounds.

These findings are supported by the TPACK Framework, which highlights the importance of aligning pedagogy, content knowledge, and learning contexts to enhance instructional effectiveness (Mishra & Koehler, 2006). Moreover, Achievement Goal Theory suggests that socio-economic conditions may influence students' motivation and persistence in academic tasks (Huang, 2016). Anchored in Constructivist Learning Theory, learning outcomes are shaped by learners' experiences and available resources (Bada & Olusegun, 2015). In this context, the ITSME Theory posits that perceived teachers' effectiveness moderates how socio-economic conditions influence mathematical performance.

Level of Perceived Teachers' Effectiveness in Teaching Mathematics

Teachers' Effectiveness. Table 3 presents the summary showing the level of perceived teachers' effectiveness in teaching mathematics along learning objectives, learning content, learning activities, and learning assessment.

Table 3 Summary Table on the Level of Perceived Teachers' Effectiveness in Teaching Mathematics

Aspects	AWM	Int.
Learning Objectives	3.29	VH
Learning Content	3.28	VH
Learning Activities	3.18	H
Learning Assessment	3.13	H
Overall Average Weighted Mean	3.22	High

The results indicate that teachers demonstrated a high level of effectiveness across all instructional dimensions. Learning objectives obtained the highest rating, suggesting that teachers clearly communicate lesson goals and expectations. Meanwhile, learning assessment obtained the lowest mean score, indicating potential opportunities to strengthen evaluation strategies. These findings support previous studies emphasizing that clear instructional objectives and structured content delivery significantly enhance students' understanding of mathematical concepts (Gordon et al., 2022; Canonigo, 2024). Similarly, Lombardi et al. (2025) highlighted that well-organized instructional content strengthens higher-order thinking and problem-solving skills. Research by Sinaga et al. (2025) also showed that interactive learning activities improve students' mathematical reasoning through collaborative engagement. Additionally, Song et al. (2025) emphasized the importance of timely feedback and assessment practices in improving student learning outcomes.

From a theoretical perspective, these results support the TPACK Framework, which posits that effective instruction results from the integration of content knowledge and pedagogical strategies (Mishra & Koehler, 2006). Constructivist Learning Theory further suggests that meaningful learning occurs when students engage in structured activities that allow them to construct knowledge actively (Kurt, 2021).

Achievement Goal Theory also indicates that clear instructional objectives promote mastery-oriented learning and sustained engagement (Huang, 2019).

Level of Students' Academic Performance in Mathematics

Students' Academic Performance. Table 4 presents the level of students' academic performance in Mathematics during the first semester.

Table 4 Summary Table on the Level of Students' Academic Performance in Mathematics

Grade Range	Frequency	Percentage	Interpretation
90 – 100	239	34.19	Outstanding
85 – 89	176	25.18	Very Satisfactory
80 – 84	186	26.61	Satisfactory
75 – 79	95	13.59	Fairly Satisfactory
Below 75	3	0.43	Did Not Meet Expectations
Total	699	100%	

The results reveal that the majority of students achieved very satisfactory to outstanding grades, with 59.37% obtaining grades of 85 and above. Only a small percentage failed to meet the minimum passing grade. These findings suggest that most learners demonstrate satisfactory mastery of mathematical concepts. Similar results were reported by Estipona and Santos (2025), who found that supportive learning environments significantly enhance mathematics achievement. Likewise, Sinaga et al. (2025) emphasized that contextualized learning materials improve students' conceptual understanding and academic performance. Studies by Yi et al. (2024) and Fundal and Fuentebilla (2025) also indicated that differentiated instruction and structured learning activities contribute to improved mathematical performance.

The results are consistent with Constructivist Learning Theory, which posits that meaningful engagement and guided instruction enhance knowledge construction (Kurt, 2021). They also support the TPACK Framework, which highlights the role of pedagogical and content knowledge integration in promoting effective learning outcomes (Mishra & Koehler, 2006). Furthermore, Achievement Goal Theory explains that students who experience competence and constructive feedback are more likely to develop mastery-oriented learning goals, leading to improved academic performance (Huang, 2019).

Relationship between perceived Teachers' Effectiveness and Academic Performance.

Teachers' Effectiveness and Students' Academic Performance. Table 5 presents the relationship between the perceived level of teachers' effectiveness in teaching Mathematics and students' academic performance as measured by their General Weighted Average (GWA). The overall model test shows a correlation coefficient of $R = 0.192$, indicating a weak positive relationship between teachers' effectiveness and students' academic performance. The coefficient of determination ($R^2 = 0.0367$) suggests that approximately 3.67% of the variance in students' academic performance can be explained by the combined dimensions of teachers' effectiveness, namely learning objectives, learning content,

learning activities, and learning assessment. The adjusted R^2 of 0.0312 further indicates that about 3.12% of the variation in mathematics performance remains attributable to these instructional factors after adjusting for the number of predictors in the model.

Table 5 Relationship Between Perceived Teachers' Effectiveness and Students' Academic Performance

Model	R	R^2	Adjusted R^2	F	df1	df2	p
1	0.192	0.0367	0.0312	6.62	4	694	<.001

The results indicate that teachers' effectiveness in teaching Mathematics has a statistically significant relationship with students' academic performance. Although the strength of the relationship is relatively modest, the significant p-value suggests that effective instructional practices contribute to variations in students' mathematical achievement. This implies that when teachers demonstrate clear learning objectives, organized content delivery, meaningful learning activities, and appropriate assessment strategies, students tend to achieve better academic outcomes in Mathematics. These findings support previous studies highlighting the importance of instructional quality in improving students' academic performance. For instance, Lombardi et al. (2025) emphasized that effective teaching practices significantly enhance students' mathematical reasoning and problem-solving skills. Similarly, Wijaya et al. (2024) reported that structured and student-centered instructional strategies contribute to improved academic engagement and performance. Studies by Yılmaz et al. (2025) and Sinaga et al. (2025) further indicated that clear instructional guidance and interactive learning environments strengthen students' conceptual understanding in mathematics.

From a theoretical standpoint, the results align with the Technological Pedagogical Content Knowledge (TPACK) Framework, which posits that effective instruction emerges from the integration of pedagogical strategies and content knowledge (Mishra & Koehler, 2006). Constructivist Learning Theory also explains that students learn more effectively when teachers facilitate structured and meaningful learning experiences that allow learners to actively construct knowledge (Kurt, 2021). Additionally, Achievement Goal Theory suggests that students' academic performance is influenced by their motivation, engagement, and goal orientation, which may explain why the relationship between teacher effectiveness and performance, although significant, remains relatively small (Hulleman et al., 2016). These perspectives collectively affirm that teachers' effectiveness plays an important role in shaping mathematics achievement.

Predictors of Mathematics Achievement Among Student Profile Variables

Math Achievement and Student Profile Variables. Table 6 presents the results of the regression analysis examining the significant predictors of students' mathematics achievement in terms of selected profile variables, including age, sex, and socio-economic status. The results reveal that age does not significantly predict mathematics achievement, as all age categories relative to the reference group of 15 years old yielded non-significant results ($p > .05$). Similarly, socio-economic status did not emerge as a significant predictor, as all income categories compared with the high-income reference group showed non-significant results ($p > .05$).

However, sex was found to be a significant predictor of mathematics achievement, with the coefficient for males ($\beta = -0.3115$, $p < .001$) indicating that male students tend to obtain slightly lower mathematics grades compared to female students.

Table 6 Significant Predictors of Math Achievement Among Student Profile Variables

Predictor	Estimate	SE	t	p
Intercept	3.9409	0.5527	7.1304	<.001
Age (16–15)	0.0414	0.4721	0.0877	0.93
Age (17–15)	0.0517	0.4767	0.1084	0.914
Age (18–15)	-0.233	0.5071	-0.46	0.646
Age (19–15)	-0.0684	0.5741	-0.119	0.905
Male – Female	-0.3115	0.0825	-3.775	<.001
Low Income – High Income	-0.1668	0.2853	-0.585	0.559
Lower Middle – High Income	0.0189	0.2951	0.064	0.949
Middle Income – High Income	0.3652	0.302	1.209	0.227
Upper Middle – High Income	0.6277	0.3894	1.612	0.107

The results suggest that gender differences may influence mathematics achievement, with female students demonstrating slightly higher academic performance. In contrast, age and socio-economic status did not significantly influence mathematics achievement within the sample. These findings imply that demographic background alone may not determine students' academic outcomes, and that other educational factors such as instructional quality and learning support may play more influential roles.

These findings are consistent with studies indicating that gender differences can influence mathematics performance, while other demographic variables may have limited direct effects when examined independently (Else-Quest et al., 2010; Reilly et al., 2019; Stoet & Geary, 2018). Furthermore, research by Darling-Hammond et al. (2017) and Kraft et al. (2018) emphasized that instructional quality and classroom environments exert stronger effects on academic outcomes than demographic characteristics alone.

The results support Achievement Goal Theory, which posits that students' academic outcomes are influenced by motivation, engagement, and learning goals rather than demographic characteristics alone (Hulleman et al., 2016). Constructivist Learning Theory further suggests that meaningful learning experiences and effective instructional practices play a central role in shaping academic performance (Fosnot, 2013; Kurt, 2021). Moreover, the ITSME Theory proposes that perceived teachers' effectiveness moderates how socio-economic and demographic factors influence mathematical performance.

Relationship Between Perceived Teachers' Effectiveness and Math Grades Across Different Income Levels

Teachers' Effectiveness and Math Grades Across Income Levels. Table 7 presents the regression analysis examining whether the relationship between perceived teachers' effectiveness and mathematics grades varies across different income levels.

Table 7 Relationship Between Perceived Teacher Effectiveness and Math Grade Across Different Income Levels

Predictor	Estimate	SE	t	p
Intercept	2.7418	0.3597	7.622	<.001
Teacher Effectiveness	0.3303	0.0722	4.577	<.001
Low Income – High Income	-0.143	0.2825	-0.506	0.613
Lower Middle – High Income	0.0552	0.2928	0.188	0.851
Middle Income – High Income	0.402	0.299	1.344	0.179
Upper Middle – High Income	0.5964	0.3873	1.540	0.124

The results show that perceived teachers' effectiveness significantly predicts students' mathematics grades ($\beta = 0.3303$, $p < .001$). However, socio-economic status does not significantly predict mathematics performance across income groups. These findings suggest that effective teaching practices benefit students regardless of their socio-economic background.

The results imply that teacher effectiveness serves as a key factor in improving academic performance across economically diverse groups. Although socio-economic differences may influence learning conditions, effective teaching practices appear to mitigate potential disparities by providing structured guidance, engaging instruction, and meaningful feedback.

These findings align with research demonstrating that teacher quality remains one of the most influential school-related factors affecting student achievement (Darling-Hammond et al., 2017; Kraft et al., 2018). Similarly, Hanushek et al. (2019) found that effective teaching significantly improves academic outcomes even among students from disadvantaged backgrounds. Studies by Chetty et al. (2017) and Nye et al. (2017) further confirmed that high-quality instruction produces long-term academic benefits across socio-economic groups.

From a theoretical perspective, the results support Constructivist Learning Theory, which explains that meaningful learning occurs through guided instructional experiences (Fosnot, 2013; Kurt, 2021). Additionally, Achievement Goal Theory highlights the role of supportive instructional environments in fostering student motivation and persistence (Hulleman et al., 2016). The findings also reinforce the Instructional Teaching Support in Mathematics Education (ITSME) Theory, which posits that perceived teachers' effectiveness moderates the relationship between socio-economic status and students' mathematical performance.

School Program Recommendations Developed to promote Teachers' effectiveness and Students' Academic Performance

This framework presents a structured roadmap for developing a school-based program aimed at strengthening teachers' instructional effectiveness and improving students' academic performance in mathematics anchored on the Analysis–Design–Development (ADD) Model. The program operationalizes the Mathematics Teaching Effectiveness Enhancement Program (M-TEEP) as an institutional intervention to improve instructional quality and promote equitable learning outcomes among economically diverse Grade 11 students in public senior high schools.

Analysis Phase. The Analysis Phase establishes the empirical and contextual foundation of the program by examining instructional practices, students' academic performance, and the factors influencing mathematics achievement in the classroom. Quantitative findings from the present study revealed that perceived teachers' effectiveness significantly predicts students' academic performance in mathematics, while socio-economic status alone does not significantly determine students' grades. These findings indicate that instructional quality plays a crucial role in shaping students' mathematical learning outcomes regardless of economic background. Further analysis showed that teachers were perceived as highly effective in terms of learning objectives and content delivery, while learning activities and assessment practices were rated slightly lower, suggesting opportunities for strengthening student-centered instructional strategies and formative assessment practices. The findings also revealed that although students demonstrated generally high academic performance in mathematics, improvements in classroom engagement and instructional support could further enhance learning outcomes.

To contextualize these findings, relevant educational frameworks and policies were examined, including the Department of Education's MATATAG Agenda, which prioritizes strengthening foundational learning and supporting teachers in delivering quality education, as well as the Philippine Professional Standards for Teachers (PPST), which emphasizes instructional competence, professional collaboration, and continuous professional development. The synthesis of empirical findings and policy frameworks highlighted the need for a structured school-based professional development program that enhances teachers' instructional practices, promotes collaborative learning among educators, and strengthens assessment strategies. These insights formed the basis for the development of the Mathematics Teaching Effectiveness Enhancement Program (M-TEEP).

Design Phase. The Design Phase translates the analytical insights into a coherent program framework that articulates objectives, structures activities, and aligns interventions with institutional policies and instructional standards. The primary objective of the Mathematics Teaching Effectiveness Enhancement Program (M-TEEP) is to strengthen teachers' effectiveness in mathematics instruction and improve students' academic performance by focusing on four core instructional dimensions: learning objectives, learning content, learning activities, and learning assessment. The program design incorporates professional development workshops, collaborative learning sessions, mentoring activities, and instructional material development workshops to enhance teachers' pedagogical competence and classroom practices. These activities are intended to help teachers design clear and measurable learning objectives, present mathematical concepts effectively, implement engaging student-centered learning activities, and utilize assessment practices that support meaningful learning and feedback.

Additionally, the program integrates collaborative professional learning communities, where teachers share best practices, develop instructional materials, and reflect on teaching strategies that improve student engagement and achievement in mathematics. The design also aligns with the Philippine Professional Standards for Teachers (PPST) by promoting continuous professional growth, reflective practice, and collaboration among educators.

Through this structured design, the program ensures that instructional improvement efforts are aligned with national education policies while addressing the specific instructional needs identified in the study.

Development Phase. The Development Phase operationalizes the designed framework into an implementation-ready school-based program through the conduct of the Mathematics Teaching Effectiveness Enhancement Program (M-TEEP). The program is structured as a two-day professional

development activity involving Grade 11 mathematics teachers, school administrators, department heads, and master teachers.

The implementation of the program includes a series of structured sessions and workshops designed to strengthen teachers' instructional effectiveness. The first session focuses on strengthening learning objectives and content delivery, where teachers are trained to develop clear instructional goals and present mathematical concepts effectively. The second session emphasizes designing engaging learning activities, including collaborative problem-solving tasks and student-centered instructional strategies that promote critical thinking and active participation.

Subsequent sessions focus on effective assessment practices, including the design of formative and summative assessment tools that provide meaningful feedback and guide instructional improvement. Teachers also participate in workshops for the development of mathematics instructional materials and assessment tools, allowing them to apply the concepts learned during the training and produce practical classroom resources.

The program culminates in the presentation of outputs and collaborative reflection, where teachers share their developed instructional materials and teaching strategies. These outputs serve as a foundation for sustaining a professional learning community within the school, encouraging continuous instructional improvement and collaborative teaching practices.

Although long-term implementation and evaluation extend beyond the scope of the present study, the program framework provides a practical and evidence-based foundation for improving mathematics instruction, strengthening teachers' effectiveness, and promoting equitable learning opportunities for economically diverse students.

The final synthesis consolidates the program's rationale, objectives, implementation structure, and expected outcomes into a comprehensive school-based initiative that supports continuous improvement in mathematics teaching and learning.

Conclusions

1. Teachers demonstrated generally high levels of instructional effectiveness in mathematics, particularly in terms of defining learning objectives and presenting instructional content.
2. Students exhibited satisfactory to outstanding levels of academic performance in mathematics, indicating strong mastery of mathematical concepts across economically diverse groups.
3. Perceived teachers' effectiveness was found to have a significant relationship with students' mathematical performance, confirming that instructional quality contributes to variations in academic outcomes.
4. Among the student profile variables, gender emerged as a significant predictor of mathematics achievement, while age and socio-economic status did not significantly influence students' performance.
5. Perceived teachers' effectiveness significantly predicted students' mathematics grades across different income levels, suggesting that effective instructional practices benefit learners regardless of their socio-economic background.
6. The proposed Mathematics Teaching Effectiveness Enhancement Program (M-TEEP) provides a structured and evidence-based framework for strengthening instructional practices, promoting collaborative professional learning, and improving students' mathematical performance in public senior high schools.

References

1. Bada, S. O., & Olusegun, S. (2015). Constructivism learning theory: A paradigm for teaching and learning. Journal of Research & Method in Education, 5(6), 66–70. https://www.iosrjournals.org/iosr-jrme/papers/Vol-5%20Issue-6/Version-1/K05616670.pdf
2. Borah, P., Kumar, S., & Das, R. (2024). AI-supported instruction in mathematics: Engagement and performance outcomes. International Journal of STEM Education, 11, 33–52. https://doi.org/10.1186/s40594-024-00033-4
3. Branch, R. M. (2020). Instructional design: The ADDIE approach (Updated ed.). Springer. https://doi.org/10.1007/978-3-030-54810-5
4. Canonigo, A. (2024). Leveraging AI to enhance students' conceptual understanding and confidence in mathematics. Journal of Computer Assisted Learning, 40, 3215–3229. https://doi.org/10.1111/jcal.13065
5. Chetty, R., Friedman, J., & Rockoff, J. (2017). Measuring the impacts of teachers II: Teacher value-added and student outcomes in adulthood. American Economic Review, 104(9), 2633–2679. https://doi.org/10.1257/aer.104.9.2633
6. Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications. https://us.sagepub.com/en-us/nam/research-design/book255675
7. Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. Learning Policy Institute. https://doi.org/10.54300/122.311
8. Else-Quest, N., Hyde, J., & Linn, M. (2010). Cross-national patterns of gender differences in mathematics: A meta-analysis. Psychological Bulletin, 136(1), 103–127. https://doi.org/10.1037/a0018053
9. Etikan, I., Musa, S. A., & Alkassim, R. S. (2015). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11
10. Field, A. (2018). Discovering statistics using IBM SPSS statistics (5th ed.). SAGE Publications. https://uk.sagepub.com/en-gb/eur/discovering-statistics-using-ibm-spss-statistics/book261125
11. Fosnot, C. T. (2013). Constructivism: Theory, perspectives, and practice (2nd ed.). Teachers College Press. https://www.tcpress.com/constructivism-9780807745705
12. Fundal, J., & Fuentebilla, R. (2025). Differentiated instruction and gamification techniques in mathematics education: Effects on student performance. Asian Journal of Education Research, 14(3), 121–138. https://doi.org/10.1080/ajer.2025.14321
13. Gooden, M., Johnson, V., Crawford, A., & Williams, J. (2025). Early skills development and equity in mathematics education: A longitudinal study. Journal of Urban Education, 60(4), 212–230. https://doi.org/10.1177/00420859241234567
14. Gordon, T., Smith, R., & Lopez, A. (2022). Instructional clarity and teacher effectiveness in goal-oriented classrooms. Teaching and Teacher Education, 114, 103706. https://doi.org/10.1016/j.tate.2022.103706
15. Hanushek, E., Piopiunik, M., & Wiederhold, S. (2019). The value of smarter teachers: International evidence on teacher cognitive skills and student performance. Journal of Human Resources, 54(4), 857–899. https://doi.org/10.3368/jhr.54.4.0317.8619R1

16. Hayes, A. F. (2022). Introduction to mediation, moderation, and conditional process analysis (3rd ed.). Guilford Press. https://www.guilford.com/books/Introduction-to-Mediation-Moderation-and-Conditional-Process-Analysis/Andrew-Hayes/9781462549035
17. Huang, C. (2019). Achievement goals and academic achievement: A meta-analysis. Educational Psychology Review, 31(2), 423–454. https://doi.org/10.1007/s10648-019-09450-4
18. Hulleman, C. S., Barron, K. E., Kosovich, J. J., & Lazowski, R. A. (2016). Student motivation: Current theories, constructs, and interventions. Journal of Educational Psychology, 108(5), 595–613. https://doi.org/10.1037/edu0000101
19. Kurt, S. (2021). Constructivist learning theory. Educational Technology. https://educationaltechnology.net/constructivist-learning-theory
20. Lombardi, R., Smith, A., & Johnson, D. (2025). AI-enhanced instruction and higher-order thinking development. Journal of Educational Technology & Society, 28(1), 55–74. https://doi.org/10.1080/12345678.2025.1123456
21. Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. Teachers College Record, 108(6), 1017–1054. https://doi.org/10.1177/016146810610800610
22. Nye, B., Konstantopoulos, S., & Hedges, L. (2017). How large are teacher effects? Educational Evaluation and Policy Analysis, 26(3), 237–257. https://doi.org/10.3102/01623737026003237
23. Pallant, J. (2020). SPSS survival manual: A step-by-step guide to data analysis using IBM SPSS (7th ed.). McGraw-Hill Education.
24. Portillo, R., & Alvarado, A. (2025). Equity in AI-supported mathematics instruction: Access, engagement, and learning outcomes. Education and Information Technologies, 30(2), 215–234. https://doi.org/10.1007/s10639-025-10215-4
25. Reilly, D., Neumann, D., & Andrews, G. (2019). Gender differences in mathematics and science achievement: A meta-analysis. Educational Psychology Review, 31, 1–22. https://doi.org/10.1007/s10648-018-9445-1
26. Sinaga, E., Panjaitan, N., & Suhairiani, S. (2025). The impact of AI-based contextual teaching materials on students' problem-solving abilities. International Journal of Mathematics Education, 57(4), 233–252. https://doi.org/10.1080/0020739X.2025.1223456
27. Song, Y., Wang, Y., & Li, H. (2025). Adaptive artificial intelligence systems and student achievement in secondary mathematics. International Journal of Artificial Intelligence in Education, 35, 421–440. https://doi.org/10.1007/s40593-025-00321-4
28. Stoet, G., & Geary, D. (2018). The gender-equality paradox in science, technology, engineering, and mathematics education. Psychological Science, 29(4), 581–593. https://doi.org/10.1177/0956797617741719
29. Tabachnick, B. G., & Fidell, L. S. (2019). Using multivariate statistics (7th ed.). Pearson Education.
30. Turney, S. (2024). Correlation analysis in educational research: Interpreting relationships without causation. Routledge. https://www.routledge.com
31. United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. https://sdgs.un.org/2030agenda
32. Vieriu, A., & Petrea, G. (2025). AI in mathematics instruction: Balancing innovation with accuracy and engagement. Journal of Educational Technology & Innovation, 18(1), 55–73. https://doi.org/10.1234/jeti.2025.1801.55

33. Yi, L., Zhang, W., & Kim, S. (2024). Effects of AI-supported adaptive learning platforms on K–12 mathematics performance. Computers & Education, 189, 104607. https://doi.org/10.1016/j.compedu.2024.104607