Journal of Education and Learning Reviews, 2 (5): September-October 2025 ISSN: 3057-0387
Website: https://so19.tci-thaijo.org/index.php/JELS/about

The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students

Hanifah E. Daluma
Teacher 1, Pantar National High School, DepEd Philippines
E-mail: hanifah.daluma@deped.gov.ph ORCID ID: https://orcid.org/0009-0007-8352-8474

Aniceto B. Naval
Associate Professor I, Northwestern Mindanao State College of Science and Technology
E-mail: aniceto.naval@nmsc.edu.ph ORCID ID: https://orcid.org/0000-0002-7954-4195

Received 25/06/2025	Revised 01/07/2025	Accepted 21/07/2025

Abstract

Background and Aim: Filipino Grade 10 students earn strong school-assigned grades yet continue to post some of the lowest mathematics scores worldwide. Because language proficiency may channel subject-matter knowledge into quantitative success, this study examined whether English achievement, operationalized as the final English subject grade, mediated the relationship between Science and Mathematics performance in a Philippine public high school.

Materials and Methods: Archival final grades for Science (X), English (M), and Mathematics (Y) were retrieved for 251 Grade 10 students enrolled in a Philippine public high school. Descriptive statistics and Pearson correlations were calculated in Jamovi. A single-mediator path model was estimated via ordinary-least-squares regression with bias-corrected bootstrapping (5,000 resamples) to obtain indirect (a × b), direct (c′), and total (c) effects.

Results: Mean grades were high (Science M = 89.8, SD = 4.6; English M = 89.1, SD = 4.6; Mathematics M = 88.5, SD = 4.4). Significant positive correlations emerged among all subjects (Science–English r = .694; Science–Math r = .514; English–Math r = .546; all $p < .001$). Path a (X → M) was significant (b = .616, SE = .052, $p < .001$), as was path b (M → Y; b = .574, SE = .135, $p < .001$). The indirect effect of Science on Mathematics through English was significant (b = .353, 95% CI [.18, .35]), while the direct effect remained significant (c′ = .144, SE = .056, p = .010), indicating partial mediation.

Conclusion: English achievement, measured via the dedicated English-subject grade, partially explained the Science–Mathematics linkage. This suggests that integrating language support into STEM curricula may yield measurable gains, especially in linguistically diverse settings such as the Philippines. Strengthening language proficiency within science instruction may therefore enhance mathematics outcomes at this pivotal stage of secondary education.

Keywords: Academic Achievement, Mediation Analysis, English Proficiency, Science Achievement, Mathematics Achievement, Grade 10

Introduction

Mathematics achievement shapes students' access to higher education and employment in science, technology, engineering, and mathematics (STEM) fields. Yet Filipino secondary learners continue to lag sharply behind international standards. In the 2022 Programme for International Student Assessment (PISA), Filipino 15-year-olds averaged 355 points in mathematics against an OECD mean of 472, an estimated learning gap of five to six school years (Organization for Economic Co-operation and Development [OECD], 2023). Achievement on standardized assessments like PISA is intended to capture transferable, cross-curricular skills, whereas classroom assessments often reflect curriculum-specific competencies and instructional alignment. Understanding how competencies in other core subjects translate into stronger mathematics performance is therefore a pressing concern for Philippine education.

Growing evidence links language proficiency with mathematics success, particularly in multilingual and English-as-a-Second-Language contexts. Roslan and Chen (2022) reported that English achievement significantly predicted mathematics grades in Malaysian secondary schools, while Mallika and Ali Mohammed (2024) showed that stronger English skills improved word-problem solving among Qatari ESL students. These findings support a theoretical model in which language proficiency enables students to decode mathematical tasks, follow procedural steps, and articulate reasoning—making it a plausible mediator between content-specific knowledge and problem-solving performance. Because the Philippines offers a dedicated English curriculum from elementary through junior high school, the final English subject grade provides an objective, curriculum-aligned indicator of language proficiency that may facilitate mathematical reasoning.

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

Parallel research documents a robust association between science and mathematics achievement. The Trends in International Mathematics and Science Study (TIMSS) consistently reports strong, positive correlations between these domains (Mullis et al., 2020), reflecting shared demands for quantitative reasoning and problem-solving. However, despite this documented relationship, few studies have empirically tested mediating mechanisms using student-level academic records (e.g., Al-Mutawah & Fateel, 2018; Zhu, 2021), leaving the process-level pathways between science and mathematics underexplored.

The present study addresses this gap by treating English achievement, as measured by the end-of-year English subject grade, as a potential mechanism through which science performance influences mathematics outcomes. Using archival grades avoids self-report bias and captures continuous performance data, while bias-corrected bootstrapping provides robust indirect-effect estimates even under non-normal grade distributions (Steinmayr et al., 2022).

Specific research objectives, detailed in the Statement of the Problem, were to (1) describe Grade 10 achievement levels in Science, English, and Mathematics; (2) examine pairwise relationships among these grades; (3) test whether English achievement mediates the science–mathematics link; (4) demonstrate the utility of bootstrapped mediation on archival DepEd data; and (5) contribute grade-specific evidence from a Philippine public high school. By exploring the mediating cognitive-linguistic mechanisms that connect subject-area performance at a pivotal transition point in secondary schooling, this study aims to inform integrated language-and-STEM instructional strategies and policy decisions.

Objectives

This study aimed to examine the mediating role of English achievement in the relationship between Science and Mathematics achievement among Grade 10 students in a Philippine public high school. The analysis was guided by the following research questions, which were tested as directional hypotheses based on prior theoretical and empirical evidence:

1. Grade 10 students demonstrate relatively strong performance of achievement in English, Science, and Mathematics based on their final grades.

2. Science achievement is significantly positively associated with Mathematics achievement.

3. Science achievement is significantly positively associated with English achievement.

4. English achievement is significantly positively associated with Mathematics achievement.

5. English achievement significantly mediates the relationship between Science and Mathematics achievement.

Literature review

Academic achievement is commonly assessed through course grades, classroom tests, and standardized examinations, which provide continuous, curriculum-aligned indicators of student mastery (Steinmayr et al., 2022). In the Philippine context, archival end-of-year grades in English, Science, and Mathematics offer several advantages: they are objective records unaffected by self-report bias, capture authentic classroom performance, and reflect the ecological validity of daily learning (Roslan & Chen, 2022). Relying on these routine Department of Education records ensures that the present study uses real-world data aligned with competencies set out in the K–12 curriculum.

Extensive evidence links English proficiency and mathematics success across diverse settings. Language competence supports many stages of mathematical problem solving, including decoding word problems and articulating multistep reasoning. Mallika and Ali Mohammed (2024) reported that English grades explained more than 30 percent of the variance in complex word-problem performance among secondary ESL learners after controlling for prior mathematics ability. Sandilos et al. (2020) found that limited English proficiency predicted lower mathematics and science grades in U.S. fifth-graders, and McMackin et al. (2022) showed that English ability remained a significant predictor of interim mathematics assessments even after accounting for computation fluency and oral-reading skills. Taken together, these studies indicate that, in many cases, strong language achievement contributes directly to higher mathematics performance.

Research also demonstrates a robust association between science and mathematics achievement. Hakim (2023) observed a high correlation between science and mathematics grades in Indonesian secondary schools, whereas Al-Mutawah and Fateel (2018) reported that science grades accounted for more than half of the variance in mathematics achievement in a Gulf-region sample after controlling for grit and attitude. Analyses of TIMSS data show that mathematics competence predicts science performance even when reading ability is included in the model (Zhu, 2021), and STEM-integrated

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

pedagogy has been found to raise achievement in both subjects simultaneously (González & Hansen, 2014). Although these studies confirm consistent cross-subject links, their correlational designs do not identify the processes that connect achievement in the two domains.

Linguistic Interdependence Theory proposes that cognitive-academic language proficiency developed in one subject can support learning in others (Cummins, 1979). Empirical work has extended this framework using mediation models: Mallika and Ali Mohammed (2024) and Ardasheva et al. (2017) showed that vocabulary knowledge and language status, respectively, transmit effects to content-area comprehension. These findings provide both theoretical and methodological support for examining English achievement as a mediating pathway between science knowledge and mathematics performance.

To date, however, no published study has tested whether the final English subject grade mediates the effect of science achievement on mathematics achievement using archival data from Grade 10 students in Philippine public schools. Grade 10 is a pivotal year in the national curriculum because it precedes the transition to senior high school and often determines academic streaming and elective choices. Previous investigations have pooled multiple grade levels or relied on international samples, leaving this key transition point underexplored. By modelling English achievement as a performance-based mediator within a single Filipino cohort, the present study addresses these gaps, clarifies cross-disciplinary mechanisms, and offers evidence to inform integrated language-and-STEM instructional strategies.

Conceptual Framework

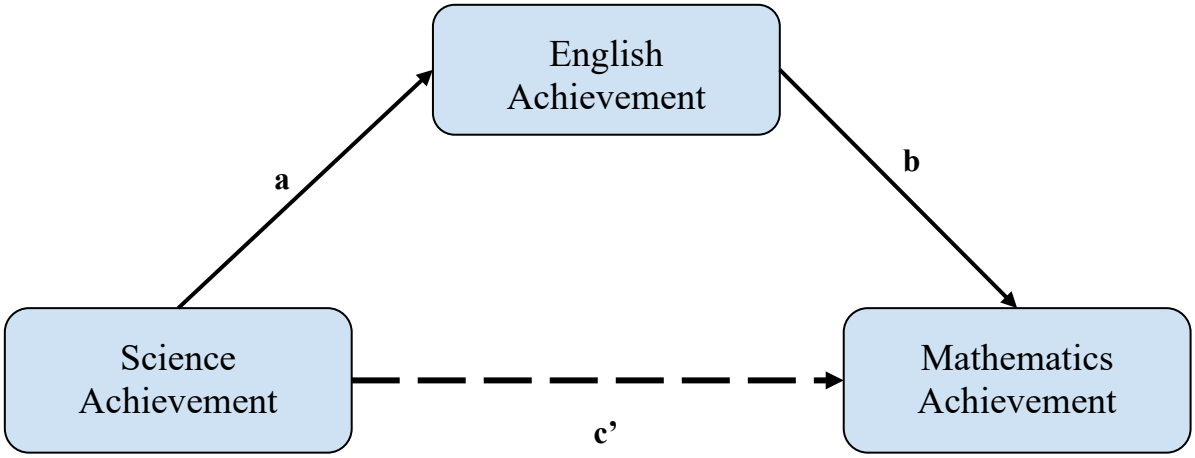

Figure 1. Conceptual mediation model of Science Achievement (X), English Achievement (M), and Mathematics Achievement (Y).

Figure 1 shows the single-mediator model tested in this study, Science achievement (X) is expected to influence Mathematics achievement (Y) through two paths. Path a runs from Science to English achievement, indicating that skill in Science can strengthen language proficiency. Path b runs from English to Mathematics, indicating that stronger language skills facilitate mathematics problem solving. The dashed arrow is the direct path c′ from Science to Mathematics that remains after English achievement is taken into account. A significant indirect effect (a × b) combined with a smaller yet significant direct effect (c′) would indicate partial mediation. This model extends prior correlational frameworks by explicitly testing English achievement as a mediating pathway using actual grade scores.

Methodology

Research Design

A quantitative, non-experimental correlational design was adopted to test a single-mediator model in which English achievement transmits part of the effect of Science achievement on Mathematics achievement among Grade 10 students.

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

Participants

The dataset contained complete end-of-year grades for 251 Grade 10 learners (130 males, 121 females) enrolled during the 2024–2025 academic year at a public high school in Northern Mindanao, Philippines. Students belonged to six ability-grouped sections ranked from lowest (Section 1) to highest performing (Section 6).

Measures

Academic achievement in each core subject was represented by the final grade (0–100 scale) recorded in official school files: Science (predictor, X), English (mediator, M, reflecting language proficiency fostered throughout the Philippine basic-education curriculum), and Mathematics (outcome, Y). These continuous, curriculum-aligned scores provided authentic indicators for mediation analysis. Grading policies in Philippine public schools are guided by the Department of Education's standards-based assessment system, which ensures relative consistency and alignment with national competencies (DepEd Order No. 8, s. 2015).

Data Preparation

Cases with missing grades (< 1 % of records) were removed list-wise, a decision justified by the low rate of missingness and lack of discernible patterns across variables. No univariate outliers ($|z| > 3.29$) required deletion. Skewness and kurtosis values showed Science and English to be approximately normal, whereas Mathematics displayed moderate negative skew; therefore, bias-corrected bootstrapping was used to obtain robust confidence intervals for indirect effects.

Statistical Analysis

Analyses were conducted in Jamovi (v2.6.44.0), an open-source statistical platform that enables transparent computation and user-friendly visual output, with the MedMod module. Descriptive statistics and Pearson correlations first summarized achievement levels and pairwise relationships. A single-mediator path model was then estimated via ordinary-least-squares regression with 5,000 bias-corrected bootstrap resamples (Preacher & Hayes, 2008). Path a captured the effect of Science on English, path b the effect of English on Mathematics, path c′ the direct effect of Science on Mathematics after accounting for English, and the product a × b the indirect effect. Partial mediation was inferred when the indirect effect was significant and the direct effect remained significant. Results are reported as unstandardized coefficients (b), standard errors (SE), t-values, and 95 % bootstrap confidence intervals, providing a clear test of English achievement as the conduit between Science and Mathematics performance at a pivotal stage of secondary schooling.

Results

Table 1 *Grade-Band Distribution for Final English, Mathematics, and Science Grades (N = 251)*

Grade band	English *n*	English %	Mathematics *n*	Mathematics %	Science *n*	Science %
90 and above	61	24.3 %	42	16.7 %	80	31.9 %
85 – 89	60	23.9 %	96	38.2 %	64	25.5 %
80 – 84	65	25.9 %	74	29.5 %	65	25.9 %
75 – 79	64	25.5 %	36	14.3 %	42	16.7 %
Less than 75	1	0.4 %	3	1.2 %	0	0 %

Table 1 shows how students' final grades cluster across five performance bands. Nearly half of the cohort reached the two highest bands in English (90 and above = 24.3 %, 85–89 = 23.9 %), whereas Mathematics had a smaller proportion of top scores (90 and above = 16.7 %) and a larger share in the 85–89 band (38.2 %). Science displayed the strongest high-end attainment, with almost one-third of students (31.9 %) scoring 90 or higher and another 25.5 % in the 85–89 range. Mid-range performance (80–84 %) was similar across subjects, accounting for approximately 26 % of students in both English and Science and 29.5 % in Mathematics. Low-pass grades (75–79 %) were more common in Mathematics and Science (14.3 % and 16.7 %, respectively) than in English (25.5 %), while failing scores (below 75) were rare in all subjects. Overall, these distributions indicate that most Grade 10 learners achieved at least satisfactory mastery in the three core subjects, with Science exhibiting the highest concentration of top performers and Mathematics showing the widest spread across bands.

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

Table **2** Descriptive statistics for English, science, and mathematics achievement among Grade 10 students (N=251)

Subject Area	Mean (M)	Standard Deviation (SD)	Minimum	Maximum
English Achievement	87.57	5.02	74.00	98
Science Achievement	87.61	4.83	75.00	98
Mathematics Achievement	87.36	5.09	71.00	98

Final grades revealed uniformly high performance across the three core subjects. English achievement averaged 87.57 (SD = 5.02) on the 0–100 scale, with scores spanning 74–98. Science displayed a comparable mean of 87.61 (SD = 4.83) and a similar range (75–98), indicating consistent mastery of science competencies. Mathematics achievement was only slightly lower at 87.36 (SD = 5.09), with a minimum of 71 and maximum of 98. The tight clustering of means in the upper-80s underscores the relatively strong academic standing of this Grade 10 cohort across all three disciplines, providing a stable platform for examining cross-subject relationships in the subsequent analyses

Table 3 Pearson Correlations Among Final Grades in English, Mathematics, and Science

Variable	English	Math	Science
English			
Mathematics	.676 *** (r^2 = 0.457)		
Science	.695 *** (r^2 = 0.483)	.548 *** (r^2 = 0.300)	

Note. All correlations are significant at $p < .001$.

Table 3 presents the Pearson correlations among final grades in English, Mathematics, and Science, all of which were statistically significant at $p < .001$. Notably, English and Science were strongly correlated ($r = .695$, $p < .001$), with approximately 48.3% of shared variance ($r^2 = .483$), while English and Mathematics also exhibited a strong relationship ($r = .676$, $p < .001$), accounting for about 45.7% of shared variance ($r^2 = .457$). The correlation between Science and Mathematics, though slightly weaker, remained substantial ($r = .548$, $p < .001$), with roughly 30.0% shared variance ($r^2 = .300$). These coefficients confirm considerable overlap in student performance across the three core subjects. In particular, the high degree of shared variance between English and the other two subjects supports the conceptualization of English achievement as a potential mediating variable. This empirical pattern justifies the subsequent mediation modelling to determine whether English grades help explain the link between Science and Mathematics achievement.

Table 4 Single-Mediator Model Linking Science, English, and Mathematics Achievement

Effect / Path	*b*	*SE*	*Z*	*p*
Mediation Estimates				
Indirect (Science → English → Mathematics)	0.324***	0.0479	6.76	< .001
Direct (Science → Mathematics, c′)	0.124*	0.0571	2.17	.030
Total (Science → Mathematics, c)	0.447***	0.0387	11.56	< .001
Path Estimates				
Science → English (a)	0.695***	0.0417	16.65	< .001
English → Mathematics (b)	0.466***	0.0639	7.30	< .001
Science → Mathematics (c′)	0.124*	0.0571	2.17	.030

*Note. $p < .05$; ** $p < .01$; *** $p < .001$. Unstandardized coefficients from ordinary-least-squares path analysis with 5 000 bias-corrected bootstrap resamples. The indirect effect equals a × b; the total effect (c) equals indirect + direct.*

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

The mediation analysis (Table 4) showed that Science achievement exerted a significant positive effect on English achievement, $b = 0.695$, $SE = 0.0417$, $Z = 16.65$, $^{**}p < .001$ (path a), and English achievement, in turn, positively predicted Mathematics achievement, $b = 0.466$, $SE = 0.0639$, $Z = 7.30$, $^{**}p < .001$ (path b). The resulting indirect effect of Science on Mathematics was significant, $b = 0.324$, $SE = 0.0479$, $Z = 6.76$, $^{**}p < .001$, indicating that higher Science grades were associated with higher Mathematics grades through their influence on English achievement. Although smaller in magnitude, the direct effect of Science on Mathematics remained significant after controlling for English (c'), $b = 0.124$, $SE = 0.0571$, $Z = 2.17$, $p = .030$. Because both the indirect pathway and the residual direct pathway were significant, the pattern of results supports partial mediation, with approximately 72% of the total Science → Mathematics effect (0.324 / 0.447) carried through English achievement. In educational terms, this suggests that most of the observed relationship between Science and Mathematics performance can be attributed to students' English proficiency, highlighting the importance of language development in fostering success across STEM subjects.

The study's findings demonstrate a sequential relationship among Science, English, and Mathematics achievement. First, students with higher Science grades also tended to perform better in English, supporting Cummins's Linguistic Interdependence Theory (1979), which posits that cognitive-academic language proficiency developed in one domain can enhance learning in others. Second, English achievement significantly predicted Mathematics performance, consistent with prior work showing that language competence supports mathematical reasoning and problem solving (Mallika & Ali Mohammed, 2024; McMackin et al., 2022). These findings corroborate earlier studies emphasizing the interdependence of language and mathematics achievement in multilingual settings (Mallika & Ali Mohammed, 2024; Ardasheva et al., 2017). The strong correlations among English, Science, and Mathematics grades align with existing research identifying language proficiency as a foundational skill for success across STEM disciplines.

The mediation analysis further confirmed that English achievement explains most of the association between Science and Mathematics, with approximately 72% of the total effect carried through English. This result highlights the central role of language in shaping academic outcomes and supports the use of mediation models to clarify cross-subject influences. As demonstrated by Ardasheva et al. (2017), vocabulary knowledge can serve as a conduit between learner characteristics and academic performance. The pattern of results in this study supports the relevance of integrative instructional strategies that bridge language development with content mastery. Such approaches are particularly critical in linguistically diverse educational systems like that of the Philippines, where reinforcing English proficiency may improve academic outcomes not only in language-based subjects but also in Mathematics and Science.

Discussion

1. What is the level of achievement in English, Science, and Mathematics among Grade 10 students based on their final grades?

Final grades indicated that the Grade 10 cohort performed well across all three subjects. Mean scores were clustered in the upper eighties for English (M = 87.57, SD = 5.02), Science (M = 87.61, SD = 4.83), and Mathematics (M = 87.36, SD = 5.09). These values suggest that most students met or exceeded the mastery benchmarks set by the Philippine Department of Education. Carroll's school-learning model notes that high achievement is likely when students receive sufficient opportunity to learn and persevere through instructional tasks (Steinmayr, Meißner, Weidinger, & Wirthwein, 2022). The narrow standard deviations and absence of extreme outliers point to consistent grading practices in the school context.

Despite these strong internal grades, national data reveal a different picture. Filipino learners scored well below the OECD mean in mathematics on PISA 2022 (OECD, 2023), highlighting a gap between school-based assessment and external standardized measures. This gap reflects differences in construct validity: classroom grades include effort and formative components tied to local curricula, whereas PISA targets transferable mathematical literacy. Such divergence is often linked to the inclusion of effort and formative assessments in classroom grading, whereas large-scale tests focus on transferable skills (Hakim, 2023). Nonetheless, the high internal achievement levels in the present

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

sample provide a reliable baseline for examining cross-subject relationships, including the role of English proficiency in supporting performance across science and mathematics.

2. Is there a significant relationship between Science achievement and Mathematics achievement?

The moderate, positive correlation between Science and Mathematics grades ($r = .55$, $p < .001$) supports earlier findings that proficiency in one STEM area often accompanies proficiency in another. Hakim (2023) reported a comparable association in Indonesian secondary schools, while Al-Mutawah and Fateel (2018) noted that science grades explained more than half of the variance in mathematics achievement when affective factors were held constant. This overlap can be interpreted through shared cognitive demands such as proportional reasoning, data interpretation, and problem-solving with symbolic representations. In the present sample, the direct Science → Mathematics path that remained significant after mediation analysis reinforces the idea that common quantitative skills transfer across the two subjects even when language proficiency is considered.

3. Is there a significant relationship between Science achievement and English achievement?

Science and English grades showed a strong correlation ($r = .70$, $p < .001$), indicating that students who excel in English tend to excel in Science as well. This pattern aligns with Linguistic Interdependence Theory, which posits that cognitive-academic language skills developed in one domain can bolster learning in others (Cummins, 1979). Scientific inquiry relies on reading expository texts, interpreting discipline-specific vocabulary, and writing evidence-based explanations. Studies in multilingual settings have reached similar conclusions: Sandilos, Baroody, Rimm-Kaufman, and Merritt (2020) found that limited English proficiency predicted lower science achievement, and Mallika and Ali Mohammed (2024) highlighted the importance of language competence for solving science-based word problems. The strong Science–English link observed here provides empirical support for viewing English achievement as a conduit through which science learning can enhance performance in other subjects, including mathematics.

4. Is there a significant relationship between English achievement and Mathematics achievement?

The correlation between English and Mathematics grades was also strong ($r = .68$, $p < .001$). This finding is consistent with evidence that language skills facilitate mathematical reasoning by helping students decode word problems, follow multi-step procedures, and communicate solutions (Roslan & Chen, 2022; McMackin, Albers, Markham, Hall, & Moore, 2022). In the mediation model, the English → Mathematics path ($b = 0.466$, $p < .001$) remained substantial after Science achievement was included, confirming that language proficiency makes an independent contribution to mathematics performance. From an instructional standpoint, integrating explicit vocabulary and reading strategies into mathematics lessons may help learners bridge linguistic barriers and improve quantitative outcomes, a recommendation echoed by González and Hansen (2014) in their work on STEM-integrated pedagogy.

5. Does English achievement significantly mediate the relationship between Science and Mathematics achievement?

The mediation analysis supported a partial-mediation model. Science achievement strongly predicted English achievement, $b = 0.695$, $SE = 0.0417$, $p < .001$, while English achievement predicted Mathematics achievement, $b = 0.466$, $SE = 0.0639$, $p < .001$. The indirect effect was significant, $b = 0.324$, $SE = 0.0479$, $p < .001$, and the direct effect from Science to Mathematics remained significant, $b = 0.124$, $SE = 0.0571$, $p = .030$. Approximately seventy-two percent of the total Science → Mathematics effect was transmitted through English achievement. Because the study is cross-sectional, this mediation model indicates statistical association rather than definite causal direction; longitudinal data would be needed to confirm temporal ordering.

These findings align with the Linguistic Interdependence Theory proposed by Cummins (1979), which states that cognitive-academic language proficiency developed in one area enhances performance in others. Science instruction frequently engages students with technical vocabulary, expository texts, and evidence-based writing, activities that build language skills relevant to mathematical problem solving. Empirical studies have shown similar patterns: English proficiency explained significant variance in word-problem scores even after controlling for prior mathematics ability (Mallika & Ali Mohammed, 2024) and remained a strong predictor of interim mathematics assessments after accounting for computation fluency (McMackin, Albers, Markham, Hall, & Moore, 2022).

The remaining direct effect implies that content overlap between science and mathematics also contributes to student performance. Shared quantitative reasoning, proportional thinking, and data interpretation skills can travel directly from science to mathematics without relying entirely on language proficiency, a pattern noted in other STEM contexts (Al-Mutawah & Fateel, 2018; Zhu, 2021).

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

Integrating explicit language instruction into science lessons, such as systematic vocabulary teaching and guided reading of scientific texts, may therefore yield dual benefits for science understanding and mathematics achievement (González & Hansen, 2014).

Taken together, these results have implications for assessment and curriculum policy. Integrating language-rich tasks into national STEM assessments could align external measures with the linguistic demands documented here, while classroom practice can embed explicit vocabulary and reading strategies within science and mathematics lessons. Such alignment would ensure that assessment systems, teaching methods, and student support all recognize the central role of language in STEM learning.

Knowledge Contribution

This study examined how academic achievement in English, Science, and Mathematics interrelate among Grade 10 students in a Philippine public school. Results showed that students performed well across all three subjects, with mean final grades in the upper 80s. While this suggests mastery of the prescribed curriculum, it contrasts with national standardized assessments where Filipino learners have historically underperformed in mathematics. This discrepancy underscores the importance of investigating internal achievement dynamics to identify cross-subject supports for learning.

Correlational findings revealed strong associations among all three subjects, particularly between English and both Science and Mathematics. Mediation analysis further demonstrated that English achievement significantly mediated the relationship between Science and Mathematics performance. Specifically, 72% of the total effect of Science on Mathematics was transmitted through English, meaning that much of the impact of science achievement on mathematics success occurred via its positive association with English proficiency.

This study is among the first in the Philippine context to use final English subject grades as a performance-based mediator, rather than relying on proxies or self-reports of language ability. In the local curriculum, English is taught as a standalone subject, distinct from Science and Mathematics instruction, making the English grade a clear indicator of language mastery. By showing that this formal subject grade meaningfully explains achievement in other domains, the study highlights the foundational role of language proficiency in supporting success across the curriculum.

These results reinforce Cummins's Linguistic Interdependence Theory and are consistent with research showing that academic language skills developed in one domain can facilitate learning in others. The findings also suggest that integrating explicit language instruction into content-area teaching—such as using guided reading in Science or vocabulary scaffolds in Math—may yield broader academic benefits. Addressing language as both an independent academic goal and a vehicle for content learning is particularly crucial in multilingual settings such as the Philippines, where English functions as both a subject and a medium of instruction.

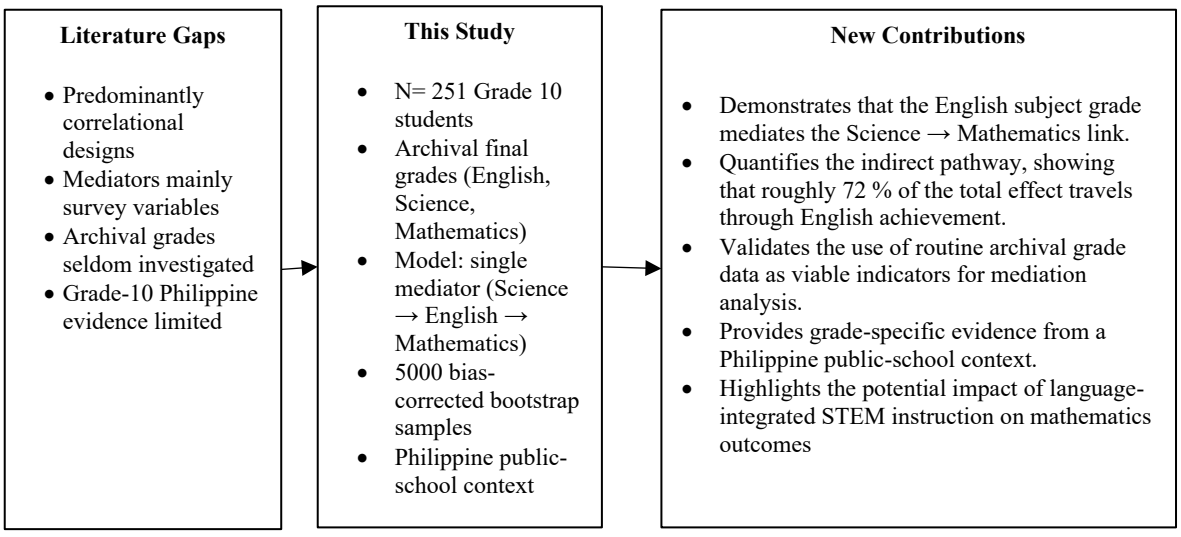

Figure 2. Knowledge Contribution

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

Figure 2 presents the study's knowledge contribution in three parts. The left panel highlights enduring gaps in the literature. Most prior studies have stopped at bivariate correlations, relied on survey-based mediators, and provided little grade-specific evidence from Philippine public schools. The center panel describes how the present study addressed these gaps. A sample of 251 Grade 10 students was analyzed using archival final grades in English, Science, and Mathematics. A single-mediator model was estimated with five-thousand bias-corrected bootstrap samples to obtain robust confidence intervals. The right panel lists the resulting contributions. Findings indicate that English achievement can carry a substantial portion of the association between Science and Mathematics achievement, that archival grade data are suitable for mediation analysis, and that grade-level evidence from a Philippine context can inform language-integrated approaches to STEM instruction.

Recommendations

In light of the study's findings, the following actions are proposed to strengthen instruction and future research:

1. **Integrate language support in STEM lessons.** Science and mathematics teachers should embed explicit vocabulary instruction and guided reading of word problems to leverage the mediating role of English achievement.
2. **Provide joint professional development.** Schools are encouraged to schedule collaborative workshops where English and STEM teachers co-plan lessons that link disciplinary texts with quantitative reasoning tasks.
3. **Use archival grades for early identification.** School leaders can routinely analyze final-grade patterns to flag students whose strong science performance is not translating into mathematics success, then direct targeted language tutoring to this group. Because English grades may partially reflect effort or classroom participation, quick diagnostic checks of language proficiency should precede intervention.
4. **Pilot language-integrated modules.** Curriculum specialists should design and test short units that combine science inquiry with structured writing and reading activities, then evaluate downstream effects on mathematics achievement.
5. **Extend research with longitudinal data.** Future studies should track cohorts over several years to examine whether the English-mediated pathway persists and employ experimental or quasi-experimental studies to test causal mechanisms, such as language-rich STEM interventions.

References

Al-Mutawah, M., & Fateel, M. (2018). Students' achievement in math and science: How grit and attitudes influence? *International Education Studies, 11*(2), 97–105. https://doi.org/10.5539/ies.v11n2p97

Ardasheva, Y., Lamb, R., Firestone, J., & Newcomer, S. (2017). Mediation in the relationship among EL status, vocabulary, and science reading comprehension. *The Journal of Educational Research, 110*(6), 665–674. https://doi.org/10.1080/00220671.2016.1175407

Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research, 49*(2), 222–251.

Department of Education. (2015). *Policy guidelines on classroom assessment for the K to 12 Basic Education Program (DepEd Order No. 8, s. 2015).* https://www.deped.gov.ph/2015/04/01/do-8-s-2015-policy-guidelines-on-classroom-assessment-for-the-k-to-12-basic-education-program/

Gao, S., Yang, L., Long, H., & Li, D. (2020). The mediation effect of student self-efficacy between teaching approaches and science achievement: Findings from 2011 TIMSS U.S. data. *Social Psychology of Education, 23*(2), 385–410. https://doi.org/10.1007/s11218-019-09534-1

González, T., & Hansen, M. (2014). Investigating the relationship between STEM learning principles and student achievement in math and science. *American Journal of Education, 120*(2), 139–171. https://doi.org/10.1086/674376

Hakim, D. (2023). Relationship between science and mathematics student learning outcomes. *Jurnal Penelitian Pendidikan IPA, 9*(5), Article 3684. https://doi.org/10.29303/jppipa.v9i5.3684

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072

Mallika, S., & Ali Mohammed, L. (2024). Mathematics through a linguistic lens: The impact of English language proficiency in solving mathematical word problems among secondary ESL students. *International Journal of Emerging Issues in Social Science, Arts and Humanities, 2*(2), 46–57. https://doi.org/10.60072/ijeissah.2024.v2i02.005

Martínez-Gregorio, S., Jiménez-Hernández, D., Galiana, L., Tomás, J., Reyes, B., & De Los Santos, S. (2022). Prediction of academic achievement in Dominican students: Mediational role of learning strategies and study habits and attitudes toward study. *Psychology in the Schools, 59*(3), 580–596. https://doi.org/10.1002/pits.22780

McMackin, M., Albers, C., Markham, M., Hall, G., & Moore, E. (2022). Predicting interim assessment outcomes among elementary-aged English learners using mathematics computation, oral reading fluency, and English proficiency levels. *School Psychology Review, 51*(4), 498–516. https://doi.org/10.1080/2372966X.2022.2041211

Mullis, I. V. S., Martin, M. O., Goh, S., & Cotter, K. (2020). *TIMSS 2019 international results in mathematics and science*. TIMSS & PIRLS International Study Center.

Organization for Economic Co-operation and Development. (2023). *PISA 2022 results*. OECD Publishing. https://doi.org/10.1787/88893296

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891. https://doi.org/10.3758/BRM.40.3.879

Roslan, M. H. B., & Chen, C. J. (2022). Predicting students' performance in English and mathematics using data-mining techniques. *Education and Information Technologies, 28*(2), 1427–1453. https://doi.org/10.1007/s10639-022-11259-2

Sandilos, L. E., Baroody, A. E., Rimm-Kaufman, S. E., & Merritt, E. G. (2020). Examining the relationship between English proficiency and mathematics achievement among elementary school students. *Journal of Educational Psychology, 112*(4), 551–574. https://doi.org/10.1037/edu0000380

Steinmayr, R., Meißner, A., Weidinger, A. F., & Wirthwein, L. (2022). Academic achievement and students' academic engagement: A meta-analysis. *Educational Psychology Review, 34*(1), 1–28. https://doi.org/10.1007/s10648-021-09620-1

Zhu, Y. (2021). Reading matters more than mathematics in science learning: An analysis of the relationship between student achievement in reading, mathematics, and science. *International Journal of Science Education, 44*(1), 1–17. https://doi.org/10.1080/09500693.2021.2007552

Citation: Daluma, H.E., & Naval, A.B. (2025). The Mediating Role of English Achievement in the Relationship Between Science and Mathematics Achievement Among Grade 10 Students. Journal of Education and Learning Reviews, 2 (5), 17-26; DOI: https://doi.org/10.60027/jelr.2025.2072