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THE ROLE OF SOCIO-ECONOMIC STATUS AND SCHOOL PRACTICES IN SHAPING STUDENTS' MATHEMATICAL PROFICIENCY

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1. ABSTRACT

This study investigated how students' socio-economic status (SES) and school practices influence mathematical proficiency among secondary learners in Region XII, Philippines. Using a descriptive-correlational design with multiple regression, data from 322 mathematics teachers across five Schools Division Offices were analyzed. SES was measured through home resources, language proficiency, and parental support, while school practices covered knowledge enhancement, instruction, assessment, curriculum alignment, and the environment. Results revealed significant positive correlations between SES and school practices with dimensions of mathematical proficiency. Regression analyses identified parental support as the strongest predictor of content knowledge, home resources for mathematical processes, and language proficiency for reasoning. Among school practices, knowledge enhancement predicted mathematical processes, while assessment predicted reasoning. Findings highlight the importance of equity-driven policies that strengthen family engagement, classroom resources, and assessment quality to address socio-economic disparities in mathematics achievement.

KEYWORDS: *Socio-Economic Status, Mathematical Proficiency, School Practices, Parental Support, Home Resources, Philippines, Secondary Education, Multiple Regression.*

2. INTRODUCTION

Mathematics proficiency is widely recognized as a cornerstone for participation in a knowledge-driven global economy and a critical pathway to social mobility. However, persistent inequalities in mathematics achievement continue to mirror entrenched socioeconomic disparities. International assessments, such as PISA, consistently demonstrate that student- and school-level socioeconomic status (SES), measured through the Economic, Social and Cultural Status (ESCS) index, exerts a significant influence on mathematics outcomes both directly and through differential opportunities to learn (OECD, 2015, 2016; Sirin, 2005).

Although prior research has established the strong link between SES and mathematics achievement, relatively few studies have examined how SES differentially affects curriculum-based mathematics performance versus application-oriented mathematical literacy, particularly in low- and middle-income country (LMIC) contexts. This gap is critical, as low performance in international assessments often signals deeper systemic challenges, including weak foundational instruction, outdated pedagogical practices, and inequitable resource distribution (Mbiti et al., 2019; Muralidharan et al., 2019). The Philippines, which consistently performs below the OECD average in mathematics, provides an important context for investigating these dynamics (OECD, 2023).

Furthermore, while family-level SES has been extensively studied, the moderating role of school-level practices remains insufficiently understood. Existing frameworks often treat student-level and school-level determinants in isolation, overlooking their combined influence on multiple dimensions of mathematical proficiency.

This study addresses these gaps by examining how SES—operationalized through home resources for learning, language proficiency, and parental support—and school practices—comprising knowledge enhancement, instructional practices, assessment, curriculum alignment, and school environment—jointly shape students' content knowledge, mathematical processes, and mathematical reasoning. Guided by Bronfenbrenner's bioecological theory (1979, 2006) and Kilpatrick et al.'s (2001) five-strand model of mathematical proficiency, the study provides a theoretically grounded and empirically rigorous analysis of the multilevel determinants of mathematics learning outcomes in the Philippine secondary school context.

3. MATERIALS AND METHODS

3.1 Research Design

This study employed a quantitative descriptive-correlational research design with multiple regression analysis. It measured the extent of SES and school-level factors influencing students' mathematical proficiency, examined the relationships among these variables, and determined the predictive influence of each factor on distinct dimensions of proficiency.

3.2 Research Setting and Participants

The study was conducted across the Schools Division Offices (SDOs) of Region XII (SOCCSKSARGEN), Philippines — a region characterised by rich socio-economic and educational diversity. Region XII encompasses both urban and rural educational settings, ranging from relatively well-resourced city-based schools to under-resourced schools in geographically isolated and disadvantaged areas (GIDAs). This diversity made it a particularly appropriate setting for investigating socio-economic influences on mathematical proficiency.

The research participants were 322 mathematics teachers purposively selected from a total population of 1,670 teachers across five SDOs using proportional stratified sampling to ensure representational validity. Inclusion criteria required participants to be regular permanent teachers, actively teaching mathematics at the secondary level, assigned within the designated divisions of Region XII, and willing to participate.

3.3 Research Instrument

The research instrument was an adopted and modified structured questionnaire comprising three parts. Part I measured students' SES profiles using a five-point Likert scale anchored at 1 (Strongly Disagree) to 5 (Strongly Agree), assessing seven home resource items, eight language proficiency items, and six parental support items. Part II measured school practices using a five-point frequency scale anchored at 1 (Very Rarely Practiced) to 5 (Always Practiced), covering 8 knowledge enhancement items, 10 instructional practice items, 10 assessment items, 10 curriculum alignment items, and 10 school environment items. Part III measured mathematical proficiency using a five-point scale anchored at 1 (Very Slightly Proficient) to 5 (Highly Proficient), covering 8 content knowledge items, 8 mathematical process items, and 10 mathematical reasoning items.

The instrument underwent expert review for content validity prior to administration and pilot testing with a subset of teachers (n = 30). The instrument demonstrated satisfactory reliability, yielding a Cronbach's alpha of 0.832. Exploratory Factor Analysis (EFA) confirmed the factor structure, identifying seven coherent factors: concrete learning, managing a positive learning environment, reflective and adaptive teaching, structuring the classroom for mathematics learning, encouraging and inclusive teaching, scaffolding, and connecting mathematics to real life. Confirmatory Factor Analysis (CFA) validated this seven-factor model, with model fit indices meeting established thresholds.

3.4 Data Collection Procedure

Following institutional ethical approval, questionnaires were distributed to selected teachers electronically and in paper format according to respondents' accessibility and preferences. Written informed consent was obtained from all participants prior to data collection. Response rates were maximised through systematic follow-up reminders. Data were entered into a secure database and subjected to quality checks before analysis.

3.5 Statistical Analysis

Data were analyzed using descriptive statistics (means and standard deviations) to characterize the levels of SES, school practices, and mathematical proficiency. Spearman's rank-order correlation (ρ) was used to examine bivariate relationships between variables given the ordinal Likert-scale measurement. Multiple linear regression analysis was employed to determine the predictive influence of SES dimensions on each component of mathematical proficiency, and similarly for school practices. Statistical significance was assessed at the 0.01 and 0.05 levels. All analyses were conducted using SPSS version 26.

3.6 Ethical Considerations

Ethical principles of informed consent, confidentiality, anonymity, justice, and transparency were strictly observed throughout the study. Participants were informed that their participation was voluntary and that their responses would not be identifiable in any reporting. All data were securely stored and anonymised prior to analysis. Conflict of interest was mitigated by clarifying that no compensation was offered for participation and that the researcher's role as a teacher did not confer any authority over participants.

4. RESULTS AND DISCUSSION

4.1 Level of Students' SES Profiles

Table 1 presents the descriptive results for the three SES dimensions. All dimensions were rated at the Agree level, with composite weighted means of 4.01 (home resources), 4.03 (language proficiency), and 4.13 (parental support). These results indicate that students generally have access to essential home learning resources, demonstrate adequate language proficiency for mathematics instruction, and receive meaningful parental involvement in their education. Notably, constant parental reminders regarding schoolwork received the highest individual item mean (M = 4.42, Strongly Agree), while bringing learning materials from home to school and having a quiet study space received the lowest item means (3.81 and 3.92, respectively), suggesting some variability in the home resource environment.

Table 1 Descriptive Statistics: Students' SES Profile Dimensions. (N = 322)

SES Dimension	Items (n)	Weighted Mean	Descriptive Level
Home Resources for Learning	7	4.01	*Agree*
Language Proficiency	8	4.03	*Agree*
Parental Support	6	4.13	*Agree*

4.2 Level of School Practices

Table 2 summarises school practice ratings across the five domains. All domains were rated at the Oftentimes Practiced level, with weighted means ranging from 3.96 (assessment) to 4.05 (knowledge enhancement and school environment). These findings indicate that schools actively but inconsistently implement the full range of practices associated with effective mathematics instruction. The practice of maintaining staff collaboration received the highest individual item mean (M = 4.26, Always Practiced), while adapting curriculum content to meet student needs (M = 3.80) and designing assessments aligned with learning objectives (M = 3.57) received the lowest ratings — the latter falling in the Sometimes Practiced range — suggesting that purposive assessment design represents a key area for development.

Table 2 Descriptive Statistics: School Practice Domains. (N = 322)

School Practice Domain	Items (n)	Weighted Mean	Descriptive Level
Knowledge Enhancement	8	4.05	*Oftentimes Practiced*
Instructional Practices	10	3.99	*Oftentimes Practiced*
Assessment Practices	10	3.96	*Oftentimes Practiced*
Alignment to Curriculum	10	4.03	*Oftentimes Practiced*
School Environment	10	4.05	*Oftentimes Practiced*

4.3 Level of Students' Mathematical Proficiency

Students demonstrated a Proficient level across all three mathematical proficiency dimensions (Table 3). Content knowledge received the highest composite mean (M = 4.15), with students achieving Highly Proficient ratings for applying mathematical formulas correctly (M = 4.40) and mastering word problems accurately (M = 4.29). Mathematical processes yielded a mean of 4.05, with explaining problem-solving steps receiving the highest item mean (M = 4.22, Highly Proficient). Mathematical reasoning produced the lowest composite mean (M = 3.93), with making connections between mathematics concepts and real-world applications (M = 3.57) and analysing mathematical arguments (M = 3.65) representing relative weaknesses — consistent with research identifying relational reasoning as a higher-order skill requiring deliberate instructional cultivation.

Table 3 Summary: Students' Mathematical Proficiency Levels. (N = 322)

Proficiency Dimension	Items (n)	Weighted Mean	Level
Content Knowledge	8	4.15	*Proficient*
Mathematical Processes	8	4.05	*Proficient*
Mathematical Reasoning	10	3.93	*Proficient*

4.4 Relationships Between SES Profiles and Mathematical Proficiency

Table 4 presents Spearman's rho correlations between SES dimensions and mathematical proficiency components. Home resources demonstrated a strong significant relationship with mathematical processes ($\rho = 0.559$, $p < .01$) and a weak but significant relationship with mathematical reasoning ($\rho = 0.178$, $p < .01$), but no significant relationship with content knowledge ($\rho = 0.042$, $p = .442$). Language proficiency showed significant positive correlations with content knowledge ($\rho = 0.179$, $p < .01$) and mathematical reasoning ($\rho = 0.421$, $p < .01$), but not with mathematical processes. Parental support demonstrated the strongest single correlation in the matrix — a very strong positive relationship with content knowledge ($\rho = 0.845$, $p < .01$) — and a significant moderate relationship with mathematical reasoning ($\rho = 0.466$, $p < .01$), but no significant relationship with processes.

These differential patterns suggest that distinct SES dimensions operate through different pathways to influence proficiency: home resources primarily facilitate procedural fluency through enabling practice, language proficiency enables the communicative and interpretive demands of reasoning, and parental support scaffolds the motivational and conceptual dimensions of content knowledge acquisition.

Table 4 Spearman's Rho Correlation Matrix: SES Profiles × Mathematical Proficiency. (N = 322)

SES Dimension		Content Knowledge	Math. Processes	Math. Reasoning
Home Resources	*ρ*	0.042	0.559**	0.178**
	p	0.442	0.000	0.001

Language Proficiency	ρ	0.179**	0.090	0.421**
	p	0.001	0.103	0.000
Parental Support	ρ	0.845**	0.032	0.466**
	p	0.000	0.562	0.000

*** Correlation significant at the 0.01 level (2-tailed).*

4.5 Influence of SES Profiles on Mathematical Proficiency

Multiple regression analyses (Table 5) revealed that the three SES dimensions collectively explained 78.7% of the variance in content knowledge ($R^2 = 0.787$, $F = 402.548$, $p < .01$), 37.1% of variance in mathematical processes ($R^2 = 0.371$, $F = 64.258$, $p < .01$), and 54.3% of variance in mathematical reasoning ($R^2 = 0.543$, $F = 129.773$, $p < .01$).

For content knowledge, parental support was the overwhelming dominant predictor ($\beta = 0.758$, $p < .01$), followed by home resources ($\beta = 0.110$, $p < .01$). Language proficiency was not a significant predictor ($\beta = -0.035$, $p = .350$). This finding underscores the primacy of family engagement and motivational scaffolding in the acquisition of mathematical content.

For mathematical processes, home resources emerged as the sole significant predictor ($\beta = 0.539$, $p < .01$), while language proficiency ($\beta = 0.103$, $p = .131$) and parental support ($\beta = -0.013$, $p = .769$) were non-significant. This supports the interpretation that procedural fluency is most directly cultivated through access to practice materials and resources rather than through social encouragement or communicative capacity.

For mathematical reasoning, all three SES dimensions contributed significantly: language proficiency was the strongest predictor ($\beta = 0.432$, $p < .01$), followed by parental support ($\beta = 0.275$, $p < .01$) and home resources ($\beta = 0.236$, $p < .01$). This pattern aligns with the higher-order nature of mathematical reasoning, which demands both communicative competency and the motivational persistence supported by engaged families.

Table 5 Multiple Regression: SES Profiles as Predictors of Mathematical Proficiency Dimensions.

Predictor	**β**	**SE β**	**t**	**p**	**Outcome**
Home Resources	0.110	0.027	4.076	<.01**	*Content Knowledge*
Language Proficiency	−0.035	0.037	−0.936	.350	*Content Knowledge*
Parental Support	0.758	0.025	30.477	<.01**	*Content Knowledge*
$R^2 = 0.787$	**F = 402.548**			**p < .01**	
Home Resources	0.539	0.049	10.981	<.01**	*Math Processes*

Language Proficiency	0.103	0.068	1.514	.131	*Math Processes*
Parental Support	−0.013	0.045	−0.293	.769	*Math Processes*
R^2 = 0.371	**F = 64.258**			**p < .01**	
Home Resources	0.236	0.040	5.938	<.01**	*Math Reasoning*
Language Proficiency	0.432	0.055	7.835	<.01**	*Math Reasoning*
Parental Support	0.275	0.037	7.494	<.01**	*Math Reasoning*
R^2 = 0.543	**F = 129.773**			**p < .01**	

*** p < .01.*

4.6 Relationships Between School Practices and Mathematical Proficiency

All five school practice domains demonstrated significant positive correlations with at least two of the three proficiency dimensions (Table 6). Knowledge enhancement showed the strongest correlation with mathematical processes (ρ = 0.994, p < .01), alongside significant relationships with content knowledge (ρ = 0.249, p < .01) and reasoning (ρ = 0.219, p < .01). Assessment practices demonstrated near-perfect correlations with mathematical reasoning (ρ = 0.995, p < .01) and a strong correlation with content knowledge (ρ = 0.496, p < .01). Instructional practices correlated most strongly with reasoning (ρ = 0.339, p < .01). Alignment to curriculum and school environment showed significant but more moderate correlations across dimensions.

Table 6 Spearman's Rho Correlation Matrix: School Practices × Mathematical Proficiency. (N = 322)

School Practice		**Content Knowledge**	**Math. Processes**	**Math. Reasoning**
Knowledge Enhancement	*ρ*	0.249**	0.994**	0.219**
	p	0.000	0.000	0.000
Instructional Practices	*ρ*	0.222**	0.126*	0.339**
	p	0.000	0.022	0.000
Assessment Practices	*ρ*	0.496**	0.232**	0.995**
	p	0.000	0.000	0.000
Alignment to Curriculum	*ρ*	0.162**	0.545**	0.409**
	p	0.003	0.000	0.000
School Environment	*ρ*	0.174**	0.088	0.442**
	p	0.002	0.110	0.000

*** p < .01; * p < .05.*

4.7 Influence of School Practices on Mathematical Proficiency

Regression analyses revealed remarkably distinct patterns of school practice influence across the three proficiency dimensions. For content knowledge ($R^2 = 0.356$, $F = 35.997$, $p < .01$), assessment practices emerged as the strongest positive predictor ($\beta = 0.494$, $p < .01$), followed by school environment ($\beta = 0.176$, $p < .05$) and instructional practices ($\beta = 0.121$, $p < .05$). Notably, alignment to curriculum exerted a significant negative effect ($\beta = -0.220$, $p < .01$), suggesting that rigid curriculum adherence may constrain the instructional flexibility needed to build robust content knowledge.

For mathematical processes, knowledge enhancement almost exclusively determined the outcome ($\beta = 0.998$, $p < .01$; $R^2 = 0.993$, $F = 9{,}725.281$), with all other practice variables showing negligible non-significant effects. This near-perfect predictive relationship indicates that enrichment activities and extended learning opportunities are the primary institutional mechanism through which procedural fluency is developed.

For mathematical reasoning, assessment practices were the sole significant predictor ($\beta = 1.000$, $p < .01$; $R^2 = 0.997$, $F = 21{,}467.751$), reaffirming that reasoning is not merely a product of knowledge or instruction exposure but is specifically cultivated through assessment practices that challenge students to justify, explain, and construct mathematical arguments.

4.8 SES and the Differentiated Pathways to Mathematical Proficiency

The finding that parental support explains 78.7% of variance in content knowledge — the highest R^2 value obtained for any SES-outcome pairing — constitutes perhaps the most striking result of this study. This extends the existing literature on parental involvement (Fan & Chen, 2001; Jeynes, 2007) by demonstrating not merely a significant relationship but a near-deterministic one in this particular context. Two interpretations warrant consideration. First, parental support may function as a powerful motivational scaffold that sustains the effort and persistence required to master the cumulative knowledge demands of mathematics content. Second, given the high beta coefficient, it is possible that parental support captures a broader composite of family-level educational investment that correlates with yet unmeasured variables.

The domain-specificity of home resource effects on mathematical processes, combined with their absence of direct effect on content knowledge, aligns with Cabaces (2024) and Mullis et al. (2016) in suggesting that resource access enables structured practice opportunities — a prerequisite for procedural fluency — rather than directly cultivating conceptual understanding, which may require more relational and social forms of support. This finding has direct pedagogical implications: simply providing students with more learning materials is unlikely to improve content knowledge unless accompanied by enhanced parental engagement and guided instructional practice.

The emergence of language proficiency as the dominant predictor of mathematical reasoning ($\beta = 0.432$) is consistent with Chow and Ekholm's (2019) and Cerbito's (2020) arguments regarding language as a cognitive scaffold for higher-order mathematical thinking. In the Philippine context, where English-medium mathematics instruction creates a double cognitive load for students whose home language differs from the instructional language, this finding suggests that language development interventions targeting mathematical discourse could yield disproportionate gains in reasoning proficiency.

4.9 School Practices: Distinct Mechanisms for Distinct Outcomes

The near-perfect predictive power of knowledge enhancement for mathematical processes ($R^2 = 0.993$) suggests that enrichment activities, advanced learning programmes, and extended learning opportunities collectively function as the primary institutional driver of procedural fluency — a finding that challenges the dominance of instructional methodology in conventional school improvement frameworks. This calls for a re-conceptualisation of knowledge enhancement as a core rather than supplementary school practice.

The exclusive dominance of assessment practices in predicting mathematical reasoning ($R^2 = 0.997$) substantially extends Black and Wiliam's (1998, 2024) formative assessment research by demonstrating that assessment is not merely diagnostic but formative of reasoning capacity itself. When assessment tasks require students to construct arguments, justify solutions, and evaluate the reasonableness of answers, the assessment process becomes the primary mechanism through which reasoning is developed. This finding resonates with Herbert's (2017) argument that assessing mathematical reasoning requires tasks that explicitly demand the demonstration of logical structure and justification.

The significant negative effect of curriculum alignment on content knowledge ($\beta = -0.220$) is a theoretically provocative finding that warrants further investigation. It may reflect a tension between curriculum fidelity and instructional responsiveness: teachers who adhere most strictly to prescribed curriculum sequences may have less latitude to address individual student misunderstandings, revisit foundational content, or make real-world connections — all of which contribute to robust content knowledge. This aligns with concerns raised by

Sundberg (2022) and Morony (2023) regarding the need to examine curriculum alignment across multiple layers, including the need for adaptive implementation flexibility.

4.10 The Complementarity of SES and School Practice Effects

Taken together, the results reveal a pattern of functional complementarity between SES and school practice effects: the dimensions of mathematical proficiency most strongly predicted by SES (content knowledge and reasoning) are also those most powerfully shaped by school practices (assessment and knowledge enhancement, respectively), while mathematical processes — though strongly predicted by both home resources and knowledge enhancement — appear most amenable to institutional intervention through enrichment programming. This suggests that strategically designed school practices can, to a meaningful degree, compensate for SES disadvantage in procedural and reasoning domains, consistent with the broader school effects literature (Hanushek & Woessmann, 2011; Perry & McConney, 2010).

However, the very high beta for parental support on content knowledge ($\beta = 0.758$) alongside the more modest school practice effects on the same outcome suggests that content knowledge acquisition may be the most difficult dimension to equalise through school-level interventions alone, underscoring the necessity of family engagement strategies as a complement to school-based programmes.

5. CONCLUSIONS

5.1 Conclusions

This study demonstrates that the socio-economic status of students and the school practices of their institutions jointly shape mathematical proficiency in systematically differentiated ways. Three principal conclusions emerge. First, parental support is the most powerful SES predictor of content knowledge, home resources most directly enable procedural fluency, and language proficiency is the dominant predictor of mathematical reasoning. Second, among school practices, knowledge enhancement is the near-exclusive driver of mathematical processes, while assessment is the defining institutional mechanism for developing mathematical reasoning. Third, rigid curriculum alignment may constrain rather than support content knowledge development, suggesting that schools must balance fidelity to standards with pedagogical responsiveness.

5.2 Limitations and Directions for Future Research

Several limitations of this study should be noted. First, data were collected from mathematics teachers rather than students directly; future studies should triangulate findings with student self-report data and direct assessment of mathematical proficiency. Second, the cross-sectional design precludes causal inference; longitudinal and experimental designs are needed to establish the directionality and sustainability of observed effects. Third, the study is delimited to Region XII; replication in other Philippine regions and international comparisons with similarly structured LMIC contexts would strengthen generalisability. Fourth, unmeasured variables — including teacher quality, peer effects, and individual student motivation — may account for residual variance not explained by the current model.

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