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RESEARCH ARTICLE

Gender Disparities and Socioeconomic Influences on PISA 2022 Mathematics Performance: A Multidimensional Analysis of Filipino Students

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Abstract

This study examines gender disparities and the role of socioeconomic factors in mathematics performance among Filipino students using the 2022 PISA results. It examines gender differences across mathematics content areas, process subscales, socioeconomic backgrounds, and proficiency levels. The analysis highlights the distribution of male and female students across proficiency levels, considering motivational and structural influences on learning outcomes. Findings indicate that female students generally perform better across most mathematical domains, although male students showed slight advantages in parental education and occupational status. Male learners are more represented at the highest and lowest proficiency levels, with notable gaps at the lower end, whereas female students are concentrated in middle proficiency levels, reflecting a more balanced distribution. The findings highlight the need for targeted strategies to address performance gaps in mathematics literacy.
Keywords: *Assessment; gender disparity, mathematics performance; PISA*

1. Introduction

Gender and development are global concerns tied to fairness and inclusion, particularly during adolescence, when disparities in learning outcomes can emerge and may be influenced by socioeconomic conditions. This focus aligns with Sustainable Development Goal 5

(SDG 5) of the United Nations, which promotes gender equality and facilitates inclusive access to opportunities across different socioeconomic levels. Scholars have examined gender differences and economic factors to understand their influence on international assessments, identifying patterns that can inform policy decisions and drive curricular innovations. For example, a framework was established to explain how socioeconomic, cultural, and educational policies interact, showing that policy and practice influence student outcomes while being shaped by specific contexts (Campbell, 2021). This was observed in the 2015 Program for International Student Assessment (PISA) results from 49 countries. PISA is a global study conducted by the Organization for Economic Co-operation and Development (OECD) to evaluate the reading, mathematics, and science skills of 15-year-old students. It assesses how well students can apply their knowledge to real-world problems, helping policymakers improve education systems worldwide (OECD, 2019). Among these skills, mathematics is a critical area for further investigation due to its role in preparing learners for the demands of 21st-century skills, particularly in a technology-driven workforce. This need is especially pressing in developing economies, where policy directions must align with efforts to reduce economic disparities and keep pace with more developed nations. This study examines gender disparities, socioeconomic backgrounds, and proficiency-level patterns in the PISA 2022 mathematics performance of Filipino students.

The Philippines first participated in PISA in 2018, followed by its second participation in 2022. The results revealed a score below the OECD averages in all subjects. In mathematics, the country ranked 78th out of 79 participants in 2018 and 77th out of 81 participants in 2022, reflecting persistent challenges in student performance (OECD, 2019; OECD, 2023). The 2018 results indicated that 30% to 40% of Filipino students demonstrated only basic mathematical skills, while more than 15% struggled to complete even the simplest mathematics tasks (OECD, 2019). The current literature suggests that mathematics performance is influenced by various factors, including students' socioeconomic background, attendance and punctuality, school experiences, and the availability of school resources (Wang et al., 2023). However, gender differences in specific contexts have been investigated in other parts of the globe. For example, boys and girls perform similarly in early school years, but girls often develop lower confidence and more anxiety in math as they age, while boys tend to feel less anxious (Geary et al., 2023). Conversely, males generally receive more positive reinforcement for their math abilities, increasing their confidence and willingness to engage with mathematics (Breda et al., 2023). This suggests that gender-specific feedback may influence attitudes toward math and subsequent performance. Although female students excel academically, many still feel less capable, which limits their participation in advanced mathematics (Whitcomb et al., 2020). The connection between self-perception and performance identifies how environmental factors can shape student engagement. This may help explain why Filipino students consistently perform below international standards in PISA assessments, specifically in mathematics. Despite existing research examining gender differences or attitudes separately, few studies have investigated how these disparities interact with socioeconomic status across specific competencies.

The gender-related differences, especially among mathematically challenged Filipino students, remain to be uncovered. The current situation warrants a more in-depth examination of gender differences across specific content areas and process subscales in the 2022 PISA mathematics assessment. Additionally, the socioeconomic backgrounds and their distribution across different proficiency levels need to be explored. This can help inform policy directions for curricular innovations and initiatives aimed at improving performance. Previous studies comparing the 2018 and 2022 results indicate no significant improvement in all areas (Acido & Caballes, 2024). The findings remain a concern, and some critical aspects of gender disparities in specific mathematical processes are unexplored. To address various challenges in the Philippine education system, the Second Congressional Commission on Education (EDCOM II) acknowledges gender and socioeconomic disparities that affect learners' educational opportunities and outcomes, emphasizing the need for targeted and equitable policy interventions (EDCOM 2, 2025). The report further outlines strategic recommendations aimed at addressing educational inequities and improving learning opportunities for diverse learner populations.

Based on the preceding discussion, the following research questions are formulated.

RQ1. How do male and female students perform across the mathematics content areas and process subscales in the 2022 PISA assessment?

RQ2. How do male and female students differ in terms of socioeconomic backgrounds as measured by parental education

(PARED), highest occupational status of parents (HISEI), and home possessions (HOMEPOS) in the 2022 PISA assessment?
RQ3. How are male and female students distributed across different proficiency levels in PISA 2022 mathematics literacy, and what patterns of performance are evident across these proficiency levels?

2. Literature Review

2.1 Gender Disparities in Educational Performance

The educational outcomes of adolescent students remain a key focus of research examining gender differences. The PISA gives valuable insights into these differences, as it evaluates students across various subjects using various content topics. For example, analyses of PISA data revealed that boys outperformed girls in mathematics by an average of nine score points, while girls outperformed boys in reading by an average of 24 score points across OECD countries (OECD, 2023). These findings suggest that gender disparities are not uniform across performance levels, indicating that the design, structure, and other factors may contribute to these outcomes. Institutional environments also matter, as supportive and autonomous settings are essential for enabling women to engage in more ambitious and interdisciplinary academic work (Santos, 2021). Similarly, differences observed in student performance in international assessments such as PISA may be linked to variations in educational environments

In another context, assessment formats can influence student outcomes. Some studies suggest that males may perform relatively better on multiple-choice items, while females may have an advantage on constructed-response items that require written explanations and reasoning (Marcq et al., 2024). These findings align with gender-related cognitive and behavioral tendencies, demonstrating how assessment formats differentially influence male and female students. Beyond assessment formats, classroom norms, whether set by teachers or formed through student interactions, can affect performance and motivation. Such norms shape the learning environment for both girls and boys, suggesting that teaching practices may need to consider different learning needs (Dörnyei & Muir, 2019). In education, students who can balance traits such as confidence (often associated with boys) and careful problem-solving (often associated with girls) may perform better across various subjects.

2.2 Socioeconomic Factors Influencing Academic Outcomes

Gender gaps are influenced by classroom dynamics and broader socioeconomic conditions, with results differing across countries. Socioeconomic status affects learning by influencing access to resources and opportunities, as reflected in PISA's Economic, Social, and Cultural Status (ESCS) index, which considers household possessions, parental education, and occupation (Avvisati, 2020). Scholarly reports note that students from lower SES backgrounds often face barriers such as limited resources and reduced learning opportunities. For instance, in developing countries, boys are more vulnerable to absenteeism and dropout, which has been linked to lower mathematics achievement, school disengagement, and retention (Jere et al., 2022). In contrast, students from higher SES backgrounds often show stronger academic performance, supported by better access to resources and learning opportunities. For example, school-level socioeconomic conditions can influence mathematics performance across all achievement levels, pointing to the need for policies that promote socioeconomically mixed schools to support equity (Perry et al., 2022). Such policies may help reduce the concentration of disadvantage that limits learning opportunities.

Educational disparities extend beyond economic resources, often intersecting with gender. The developing countries have shown gender-based gaps in educational enrollment and attainment (Jones & Ramchand, 2016). Children with parents in better SES conditions generally outperformed those whose parents had lower SES status due to advantages such as private tutoring and advanced educational technologies (Ahmar & Anwar, 2013). High academic expectations among parents are generally associated with greater engagement in their children's learning, with involvement partly shaped by SES (Zhang et al., 2023). Highly educated parents from the middle and young age groups were involved in school activities and regularly communicated with teachers (Erdener & Knoeppel, 2018). Students from lower SES backgrounds experienced greater learning losses during the pandemic than their higher-income peers (Haelermans et al., 2022). Low-income students may have less exposure to higher-level content areas, thereby widening the achievement gap. This insight is important where gaps in education and access to basic services majorly impact individuals' life opportunities (McDoom et al., 2019). This requires focusing on policies that address both gender and socioeconomic factors.

2.3 Theoretical Lenses for Understanding Gender Gaps

This section draws on motivational and sociological perspectives to explain how gender gaps in mathematics emerge and persist across different learning contexts. Expectancy–Value Theory (EVT) helps clarify how learners' beliefs about their own competence and the value they assign to mathematics shape their engagement and academic outcomes. In EVT, effort toward an academic task tends to increase when learners believe success is attainable (expectancy) and when the task is viewed as meaningful or worthwhile (value) (Wigfield & Eccles, 2000). Gender gaps can arise when boys and girls internalize different beliefs about their capabilities or assign different levels of importance to them due to socialization or prevailing stereotypes. Recent research has demonstrated that these expectancy–value perceptions continue to be a strong predictor of mathematics performance across diverse contexts, with motivational beliefs mediating how gender differences translate into achievement outcomes (e.g., Benden & Lauermann, 2023; Lazarides, 2022). These patterns suggest that increasing the expectancy and value of mathematics among all learners may help reduce the motivational drivers of gender gaps.

While EVT focuses on motivation at the individual level, Bourdieu's Social Reproduction Theory shifts attention to the structural influences of socioeconomic background and how these interact with gender in shaping access to valued educational resources. The theory posits that academic institutions tend to privilege the cultural capital of students from higher socioeconomic status, reinforcing existing social hierarchies through their alignment with middle-class norms and expectations (Bourdieu, 2018). In this framework, gender disparities do not arise solely from individual differences but are also conditioned by the structural advantages that support confidence, preparedness, and engagement in mathematics. These structural dynamics help explain why gender gaps tend to be wider in low-resource contexts (Reynolds, 2023)—where both cultural capital and institutional support are unevenly distributed—and narrower in better-resourced school environments.

Taken together, EVT and Social Reproduction Theory offer a complementary way of understanding how gender disparities in mathematics emerge from both individual motivation and broader structural conditions. EVT clarifies how differences in expectancy and valuing influence engagement and performance (Wigfield & Eccles, 2000), while Bourdieu's framework explains how access to cultural and educational resources is shaped by socioeconomic position (Bourdieu, 2018). Viewing the issue through both lenses helps explain why gendered patterns are not uniform across contexts but interact with opportunity structures and learning environments. This dual perspective is beneficial for interpreting PISA findings because it links motivational processes with systemic inequities, offering a more comprehensive rationale for why gaps persist over time.

3. Methods

The study employs a quantitative approach to examine gender disparities in mathematics literacy among Filipino students. Using secondary data from the Organization for Economic Co-operation and Development (OECD), specifically the 2022 PISA assessment, this analysis examined gender disparities across assessment dimensions, differences in socioeconomic backgrounds, and the distribution of students across proficiency levels. The methodology is organized into the following procedural sub-sections:

3.1 Identification of Assessment Dimensions

The PISA assessments include two primary components of the mathematical assessment framework used in this study: content areas and process subscales. The content areas represent the various domains of mathematical knowledge assessed, while the process subscales evaluate how students interact with and solve mathematical problems (De Bortoli & Underwood, 2025).

3.1.1 Content Areas

The content areas in mathematics include space and shape, change and relationships, quantity, and uncertainty (OECD, 2024). Space and shape explore students' ability to understand geometric figures, patterns, and the physical spaces around them, skills essential for activities like design and navigation. Change and relationships showcase algebraic thinking and mathematical modeling, helping students make sense of patterns and connections in everyday problems, such as budgeting or understanding trends. The quantity content area focuses on basic arithmetic and measurements, the building blocks for practical tasks like shopping or managing time. Uncertainty challenges students to interpret data, understand probabilities, and make informed decisions based on statistics, skills increasingly relevant in today's data-driven world.

3.1.2 Process Subscales

The process comprises four subscales, including students' ability to apply mathematical concepts, facts, and procedures, which involves using mathematical knowledge and methods to solve problems and reach logical conclusions (OECD, 2024). Second, interpreting, applying, and evaluating mathematical results entails analyzing solutions, understanding their significance, and translating them into real-world contexts. Third, formulating situations mathematically involves recognizing opportunities to apply mathematics in practical contexts, structuring problems effectively, and considering relevant assumptions and constraints. Lastly, mathematical reasoning involves selecting strategies, drawing conclusions, and understanding how solutions relate to mathematical theory and real-world scenarios. These skills demonstrate a well-rounded approach to applying mathematics effectively through this process.

3.2 Socioeconomic Factors in PISA Assessment

Socioeconomic status (SES) in PISA is assessed using three main indicators: Parental Education Level (PARED), Highest Occupational Status of Parents (HISEI), and Home Possessions (HOMEPOS). Each factor provides a distinct perspective on the family environment and its role in supporting student achievement. The highest level of parental education, measured in years, is represented by PAREDINT. The variable reflects the median number of years required to complete the highest education level attained by either parent, as classified under HISCED. It is derived from responses to questions ST005, ST006, ST007, and ST008, which capture the education levels of both parents. Parental occupations also significantly influence socioeconomic status, as measured by the Highest International Socioeconomic Index of Occupational Status (HISEI). This measure is based on responses to questions ST014 and ST015, where students report the occupations of parents, which are then scored according to social status and income potential using the ISCO framework. The Household Possessions Index (HOMEPOS) provides insight into family wealth and access to learning resources. Data for HOMEPOS is collected from the questionnaire (ST250 to ST256) and evaluates the availability of household items such as books, computers, and internet access.

3.3 Data Source and Sample

The study utilizes PISA secondary data from the Organization for Economic Co-operation and Development (OECD), specifically for Filipino students who participated in the 2022 assessment. The study used data from student questionnaires, which consisted of two main parts: a test measuring knowledge and a section collecting information on students' backgrounds, including their socioeconomic status. In the 2022 assessment, there were 7,193 students, comprising 3,531 males and 3,662 females (OECD, 2023). These students come from different socioeconomic backgrounds and various regions across the Philippines.

The 2022 PISA provides 10 plausible values (PVs) for performance in mathematics. These values are not actual test scores but estimates of potential ability. Since large-scale assessments like the PISA test only sample a subset of questions in each domain, it is impossible to measure overall ability directly. Instead, students' skills are evaluated using item response theory (IRT) based on latent trait models. Each PV represents a score a student might achieve, derived from their test performance and background information. The PVs are randomly selected from the distribution of proficiency estimates. This method, also employed in other international assessments, accounts for variability and uncertainty, thereby increasing the reliability and validity of the conclusions. The assessment also measures proficiency levels on the Mathematical Literacy Scale. Table 1 describes the proficiency scale in mathematics, illustrating the ability to apply mathematical concepts in real-life situations. The scale ranges from basic levels, where simple problems in familiar contexts can be solved, to advanced levels, where complex, multi-step problems can be handled. Each level clearly explains the required skills, making it easy to track progress.

Table 1

Descriptions of Proficiency Levels (OECD, 2024)

Levels	Student Skills
1c	Students can respond to straightforward questions using clearly presented, familiar information in simple formats, such as small tables or pictures. They follow a single-step instruction with minimal complexity.

1b	Students can respond to simple questions where all necessary information is clearly given in an easy-to-read format. They perform basic whole-number calculations based on direct, clearly given instructions. These students can recognize and ignore irrelevant information when answering specific questions.
1a	Students can answer clearly defined questions using all the provided information, sometimes requiring them to work with two sources simultaneously. They follow direct instructions to complete simple, routine procedures, occasionally repeating steps to solve a problem. These students use basic algorithms, formulas, or conventions, primarily working with whole numbers.
2	Students can design simple problem-solving strategies, including straightforward simulations involving one variable. They can remove relevant information from various representations, such as two-way tables and charts, and understand basic functional relationships. These students demonstrate a solid grasp of ratios and can accurately interpret results.
3	Students can develop solution strategies that involve sequential decision-making and computational thinking. They solve problems requiring multiple routine calculations and interpret different information sources. These students demonstrate an understanding of percentages, fractions, decimals, and proportional relationships.
4	Students can use specific models for real-world scenarios, which occasionally involve multiple variables. They can also create their own models using computational thinking. These students can construct and present arguments and explanations that are based on their approach and logic.
5	Students can define boundaries and make assumptions to develop models for complex situations. They use systematic problem-solving strategies and apply mathematical knowledge that is not directly stated in the task.
6	Students can solve abstract problems by applying creativity, flexible thinking, and a deep understanding of mathematics. They effectively utilize various information sources, including simulations and spreadsheets, and use symbolic and formal mathematical operations to justify their reasoning. These students can critically evaluate their solutions and reflect on their problem-solving process in relation to the original situation.

Each proficiency level is marked by a specific cut point from the scale of 0–1000 scores. Students with scores below 233 points are placed in Level 1c, while those with scores between 233 and 295 points fall into Level 1b. Scores ranging roughly between 296 and 357 points are classified as Level 1a, and those from 358 to 419 points are classified as Level 2. Level 3 covers the group from around 420 to 481 points, and students in Level 4 score between approximately 482 and 606 points. Those students with scores between 607 and 669 points are placed in Level 5. Scores that are 669 points or above qualify for Level 6. These cut points help educators see where students stand regarding key competencies and guide them in addressing any gaps.

3.4 Software

The Statistical Package for the Social Sciences (SPSS) was used to manage descriptive statistics and extract and filter data from the PISA database. The select cases tool was used to extract cases from multiple participating countries. SPSS was used to isolate and retain only the data relevant to Filipino students, allowing for targeted analysis. Another software used is the International Database (IDB) Analyzer, which the International Association developed for the Evaluation of Educational Achievement (IEA). The software is free and can analyze data from large-scale assessments. It supports data analysis from major international studies, including the NAEP (U.S. National Assessment of Educational Progress). The IDB Analyzer was used to process the filtered SPSS data. It applied linear regression to calculate Cohen's d and $z-$scores, measuring gender differences in performance. The study applied these analyses to the content areas and process subscales of the PISA mathematics assessment. The IDB Analyzer was also used to identify achievement benchmarks, compare performance levels, and determine underperformance across gender groups.

3.5 Procedures for PISA Data Analysis

This study determines the mean scores and proficiency levels of male and female students using benchmarks and a linear regression model to analyze gender differences in performance. It relies on weighted means and percentages to account for PISA's complex sampling design, ensuring results represent the entire population rather than just the sampled students.

The analyses followed the OECD-recommended procedures for PISA data analysis using the International Database (IDB) Analyzer.

Student sampling weights, plausible values, and 80 replicate weights were incorporated in all analyses to account for the complex sampling design of PISA. Sampling variance was estimated using the Balanced Repeated Replication (BRR) method with Fay's adjustment, which provides unbiased and asymptotically consistent variance estimates under complex survey designs (OECD, 2024). The Philippine PISA 2022 dataset included 7,193 students, supporting the use of large-sample normal approximation. These methodological considerations support the use of weighted means, regression analyses, and other parametric statistical procedures in the study.

3.5.1 Gender Differences and Socioeconomic Factors in PISA

Gender differences and socioeconomic factors were examined using weighted means, weighted percentages, and regression-based analyses that account for PISA's complex sampling design. By giving a weighted data structure, the mean performance score for each gender is obtained through Equation (1)

$$\widehat{M}_g = \frac{\sum W_k S_k}{\sum W_k} \quad (1)$$

where $\widehat{M}_g$ represents the weighted mean performance score for gender *g*, S_k is the performance score of student *k*, and W_k is the corresponding sampling weight. The application of weights ensures that estimates reflect the actual population representation rather than a simple arithmetic mean. The percentage of students within a particular performance bracket is computed similarly by incorporating weighted frequencies. The weighted mean was calculated separately for each gender group to derive the performance mean and standard deviation by specifying the weight variables and the grouping country identifier. After this step, performance differences between male and female students are analyzed using a linear regression model shown in equation (2)

$$P_k = \alpha + \gamma G_k + \varepsilon_k \quad (2)$$

where P_k is the performance score of student *k*, α represents the intercept or baseline performance score when the gender variable $G_k = 0$ (female), G_k is a binary variable for gender ($1 =$ male, $0 =$ female), ε_k represents the error term representing random variation not explained by gender. The coefficient γ measures the performance difference, where a positive value indicates higher male performance and a negative value indicates higher female performance. The standard error (SE) is derived from the final error variance (FEV), defined as

$$FEV = M^* + \left(1 + \frac{1}{V}\right) D_V \quad (3)$$

where FEV is the final error variance, M^* is the mean sampling variance, V is the number of plausible values, and $\mathrm{D_V}$ is the imputation variance. Based on equation (3), the FEV combines sampling and imputation variance, providing a total error variance that reflects both sampling variability and the uncertainty introduced by plausible values. The SE reflects the level of uncertainty in the estimated mean performance difference between males and females. A smaller SE indicates a more precise estimate, while a larger SE shows greater uncertainty. The PISA data use 80 replicate weights for variance estimation (OECD, 2024), resulting in approximately 79 degrees of freedom (80 – 1 = 79). With degrees of freedom above 30, the t-distribution is very close to the standard normal distribution. In this study, a z-test is used instead of a t-test because the large sample size allows the sampling distribution of the estimated gender difference to be well approximated by the normal (z) distribution. The test is expressed

$$z = \frac{\hat{\beta}}{SE(\hat{\beta})} \quad (4)$$

where $\hat{\beta}$ is the estimated difference in performance and $SE(\hat{\beta})$ is the standard error that captures variability in the data, including the PISA survey design. Based on equation (4), a large absolute value of z (e.g., greater than 1.96 for a two-tailed 5% test) indicates that the observed difference is unlikely to be due to chance alone (Pretorius et al., 2014). The corresponding p-value tells us the probability of seeing such a difference if there were truly no gap (Greenland et al., 2016). Effect sizes are reported using Cohen's d, with thresholds of 0.2, 0.5, and 0.8 interpreted as small, moderate, and large effects, respectively.

3.5.2 Proficiency Level in PISA

For student performance across different proficiency levels, benchmark analysis was applied, distributing students according to cutoff scores (e.g., Levels 1a, 1b, 2, 3, 4, and 5). The percentage of students reaching each proficiency level is determined as

$$\rho_L = \left(\frac{\sum_{i\epsilon L} \omega_i}{\sum_{i=1}^{N} \omega_i}\right) \times 100 \quad (5)$$

where ρ_L denotes the percentage of students in proficiency level L, w_i represents the survey weight assigned to student i, and N is the number of students. The numerator sums the weights of students who fall within the threshold for level L, providing the weighted count of students in that level while accounting for the stratification and clustering. The denominator sums the weights of all students, ensuring that the percentage reflects the target population rather than just the sample. As equation (5) indicates, multiplying by 100 converts the proportion into a percentage.

4. Results

The results were presented in three subsections: content and process subscales, socioeconomic factors, and proficiency levels with their links to the subscales.

4.1 Assessment Dimension in Mathematical Literacy

Table 2 shows the mathematics performance of male and female students across content areas and process subscales. Percentage analysis, mean comparisons, and linear regression were utilized to identify performance gaps and evaluate the significance of gender differences.

Table 2

Mathematics Performance Comparison by Gender

Category	Male		Female		$M_{\bar{x}} - F_{\bar{x}}$	d	z
	$\bar{x}$	s	$\bar{x}$	s			
By Content Areas							
Change and Relationships	348.7	71.1	362.89	70.00	-14.19	-0.10	-4.07***
Space and Shape	341.03	84.34	345.10	78.20	-4.08	-0.03	-1.18
Quantity	341.63	74.40	356.40	70.51	-14.77	-0.10	-6.35***
Uncertainty and Data	350.08	71.95	366.11	66.93	-16.03	-0.11	-6.70***
By Process Subscale							

Employing	343.20	72.71	359.87	66.88	-16.67	-0.12	-7.40***
Interpreting	348.75	72.09	364.55	69.19	-15.80	-0.11	-6.65***
Formulating	346.01	76.45	348.83	73.47	-2.82	-0.02	-0.76
Reasoning	342.95	76.70	357.57	73.28	-14.62	-0.10	-4.91***

Legend: ***$p < .001$, $\bar{x}$ mean, s standard deviation, $M_{\bar{x}} - F_{\bar{x}}$ mean difference (male-female), Cohen's d, negative z statistics value suggests a female advantage

The content area results (see Table 2) showed that female students scored higher than males in the three categories with significant z-values. Female students performed better than males in the content areas such as *uncertainty and data* ($M_{\bar{x}} - F_{\bar{x}} = -16.03, p < 0.001$), *change and relationship* ($M_{\bar{x}} - F_{\bar{x}} = -14.19, p < 0.001$), and *quantity* ($M_{\bar{x}} - F_{\bar{x}} = -14.77, p < 0.001$). The process subscale category reveals that *employing* got the highest mean difference, which also favors the female students with a significant mean difference of -16.67, followed closely by the *interpreting* ($M_{\bar{x}} - F_{\bar{x}} = -15.80, p < 0.001$) and *reasoning* ($M_{\bar{x}} - F_{\bar{x}} = -14.62, p < 0.001$). In contrast, *formulating* had the smallest difference but is not statistically significant.

4.2 Socioeconomic Comparison by Gender

Table 3 shows a comparison between male and female students based on three socioeconomic indicators: PARED (parents' education), HISEI (highest occupational status of parents), and HOMEPOS (home possessions).

Table 3

Socioeconomic Comparison by Gender

Category	Male		Female		$M_{\bar{x}} - F_{\bar{x}}$	d	z
	$\bar{x}$	s	$\bar{x}$	s			
PARED	6.53	2.85	5.66	2.64	0.87	0.16	12.62***
HISEI	38.32	21.29	36.21	20.17	2.11	0.05	3.09**
HOMEPOS	-1.70	1.12	-1.80	1.15	0.10	0.04	2.54*

Legend: ***$p < .001$, $\bar{x}$ mean, s standard deviation, $M_{\bar{x}} - F_{\bar{x}}$ mean difference (male-female), Cohen's d, positive z statistics value suggests a male advantage

Results showed that male students had an advantage over female students in terms of socioeconomic factors. *PARED* was significantly higher for male students than female students ($M_{\bar{x}} - F_{\bar{x}} = 0.87, p < 0.001$). A similar pattern was observed for the *HISEI* ($M_{\bar{x}} - F_{\bar{x}} = 2.11, p < 0.01$) and for *HOMEPOS* ($M_{\bar{x}} - F_{\bar{x}} = 0.10, p < 0.005$). Although these differences vary in both significance levels and differences in the means, they offer important implications that will be explored in the discussion.

4.3 Identifying of Proficiency Levels

The following subsections present the content areas and process subscales, outlining the distribution of students across proficiency levels from Level 1c (lowest) to Level 6 (highest), and analyze the performance differences between males and females.

4.3.1 Analysis of Content Areas

Tables 4 to 7 show the proficiency levels of male and female students across all mathematics content areas, including change and relationships, quantity, space and shape, and uncertainty. The percentage and number of students at each level are presented to determine whether gender disparities exist in understanding mathematical concepts and skills.

Table 4

Proficiency-Level Results by Gender across Change and Relationship Content Area

Proficiency Levels	**Change and Relationship**					
	Male %	**Male #**	**Female %**	**Female #**	$\boldsymbol{M-F}$ **%**	$\boldsymbol{M-F}$ **#**
1c	22.90	808	16.47	604	6.43	204
1b	36.75	1304	33.83	1248	2.92	56
1a	25.26	897	29.80	1099	-4.54	-202
2	10.47	369	14.15	512	-3.68	-143
3	3.49	121	4.77	169	-1.28	-48
4	0.89	28	0.86	26	0.03	2
5	0.18	4	0.11	3	0.07	1
6	0.05	1	0.01	0	0.04	1

Table 4 shows the proficiency-level differences between male and female students in the change and relationships content area. The most significant gap was found at the lowest level (1c), with females scoring 6.43% higher than males. Most students were on level 1b ($n = 2{,}552$), with males exceeding females by 2.92%. In Levels 2 to 4, the gender gap narrowed, with 3.68% more female students than male students reaching Levels 2 and 3. The gender gap at level 4was nearly equal, and very few students reached levels 5 and 6. Only one male student reached level 6.

Table 5

Proficiency-Level Results by Gender across Quantity Content Area

Proficiency Levels	Quantity					
	Male %	Male #	Female %	Female #	$M-F\%$	$M-F\ \#$
1c	28.15	1010	20.13	740	8.02	270
1b	34.64	1226	32.76	1208	1.88	18
1a	22.17	789	28.31	1041	-6.14	-252
2	10.35	363	14.34	518	-3.99	-155
3	3.16	113	3.97	138	-0.81	-25
4	0.90	26	0.45	16	0.45	10
5	0.22	4	0.04	1	0.18	3
6	0.03	1	0	0	0.03	1

Table 5 shows the proficiency levels by gender in the quantity content area. The most significant gap was found at the level 1c with a difference of 8.02%. Females demonstrate better performance at level 1a, with a 6.14% difference. A smaller gap was observed in Level 3, favoring females (-0.81%). Over 1,200 students were in Level 1b, with a gender gap of 1.88%. Only one male student was at Level 6, suggesting that achieving advanced-level performance was uncommon.

Table 6

Proficiency-Level Results by Gender across Space and Shape Content Area

Proficiency Levels	Space and Shape					
	Male %	Male #	Female %	Female #	$M-F\ \%$	$M-F\#$
1c	29.53	1041	26.07	957	3.46	84
1b	29.36	1038	30.80	1133	-1.44	-95
1a	24.39	864	26.70	977	-2.31	-113
2	11.68	415	12.37	452	-0.69	-37
3	3.78	134	3.29	119	0.49	15
4	1.04	34	0.58	21	0.46	13

5	0.17	5	0.12	3	0.05	2
6	0.07	1	0.05	1	0.02	0

Table 6 shows the proficiency levels by gender in the space and shape content area. The most significant gender gap was observed in level 1c, with males (29.53%) higher than females (26.07%). The highest number of 2,171 students, for both genders, was observed at Level 1b. Only one male student and one female student reached the highest level 6.

Table 7

Proficiency-Level Results by Gender across Uncertainty Content Area

Proficiency Levels	Uncertainty					
	Male %	**Male #**	**Female %**	**Female #**	$M - F$ %	$M - F$ #
1c	22.52	795	14.65	534	7.87	261
1b	35.35	1254	31.43	1162	3.92	92
1a	26.09	924	32.80	1210	-6.71	-286
2	11.56	411	16.67	605	-5.11	-194
3	3.49	122	4.02	138	-0.53	-16
4	0.79	22	0.39	12	0.40	10
5	0.17	3	0.04	1	0.13	2
6	0.03	0	0	0	0.03	0

Table 7 shows differences between male and female students. A significant difference was observed in the lowest proficiency level (Level 1c), with 22.52% of male students compared to only 14.65% of female students, resulting in a 7.87% gap or 261 more males than females. The highest number of students was recorded at Level 1b, totaling 2,407, with a 3.92% difference, indicating 92 more male students than female. Female students performed better at Level 1a, with 32.8% reaching this level, compared to 26.09% of males, resulting in a 6.71% gap, or 286 more females than males. At the highest proficiency level (Level 6), no students from either gender reached this level.

The overall result for the content areas shows that male students did not perform better at the lowest proficiency levels (1c and 1b). The most significant gap was Quantity at Level 1c (8.02%), where females outperformed males. At Level 1b, males showed the most significant disadvantage in the Uncertainty content area (3.92%), while females gained a slight advantage in the Space and Shape content area (1.44%). Female students outperformed males in most content areas from Level 1a to Level 3. The most significant gap was in the Uncertainty content area at Level 1a (6.71%). Females also scored higher at Level 2, with differences from 0.69% to 5.11%, and at Level 3, except in the Space and Shape content area, where males had a slight advantage (0.49%). Male students performed slightly better at higher proficiency levels (4–6), with differences of less than 1 percentage point. By Level 6, very few students reached this stage, with 0.06% of females and 0.18% of males. The most significant gap at this level was in the Change and Relationships content area (0.04%), and no female students reached Level 6 in the Quantity or Uncertainty content areas.

4.3.2 Analysis of Process Subscale

Tables 8 to 11 examine proficiency levels of male and female students across mathematical process skills—employing, formulating, interpreting, and reasoning—showing percentages and numbers at each level to identify gender differences and areas needing intervention.

Table 8

Proficiency-Level Results by Gender across the Employing Process Subscale

Proficiency Levels	Employing					
	Male %	Male #	Female %	Female #	M-F %	M-F #
1c	26.89	951	17.95	662	8.94	289
1b	35.67	1261	32.67	1204	3.00	57
1a	22.76	812	29.82	1094	-7.10	-282
2	10.24	362	15.24	552	-5.00	-192
3	3.46	118	3.82	134	-0.36	-16
4	0.80	25	0.48	15	0.32	10
5	0.17	3	0.02	1	0.15	2
6	0	0	0	0	0	0

The results in Table 8 show gender differences across proficiency levels. At Level 1c, more male students (26.89%, $n = 951$) than female students (17.95%, $n = 662$) were at this low skill level, creating an 8.94% gap. At Level 1a, more female students (29.82%) than males (22.76%) reached this level, resulting in a 7.10% difference. At Level 3, females had 16 more students than males, though the percentage difference was small (-0.36%). Level 1b had the largest number of students overall, with over 1,000 from each gender; males outnumbered females by 57. At the highest level (Level 6), no students from either gender reached this advanced stage, showing minimal achievement at the upper end of the subscale.

Table 9

Proficiency-Level Results by Gender across Formulating

Proficiency Levels	Formulating					
	Male %	Male #	Female %	Female #	M-F %	M-F #
1c	25.12	886	23.43	859	1.69	27
1b	34.34	1220	34.03	1257	0.31	-37
1a	25.65	911	26.42	966	-0.77	-55
2	10.11	359	11.74	425	-1.63	-66
3	3.37	114	3.52	126	-0.15	-12
4	0.97	32	0.67	24	0.30	8
5	0.29	7	0.15	4	0.14	3
6	0.14	2	0.04	1	0.10	1

Table 9 shows a smaller gender gap than other subscales, but differences between male and female students remain. The most significant gap was at Level 1c, where more males (25.12%, $(n = 886)$ than females (23.43%, $n = 859$) were at this lowest level, a difference of 1.69% (27 students). Female students did better at mid-levels, especially at Level 2, where females (11.74%, $n = 425$) outperformed males (10.11%, $n = 359$) by -1.63% (66 students). A smaller female advantage appeared at Level 3, with a -0.15% gap (12 students). Most students clustered at Level 1b, with over 1,000 from each gender, where males had a minimal advantage (0.31%). At the highest level (Level 6), performance was rare, with only two males and one female reaching this stage.

Table 10

Proficiency-Level Results by Gender across Interpreting

Proficiency Levels	Interpreting					
	Male %	Male #	Female %	Female #	M-F%	M-F #
1c	23.61	831	16.28	595	7.33	236
1b	35.54	1263	31.59	1165	3.95	98

1a	24.65	872	30.74	1132	-6.09	-260
2	11.64	413	16.37	596	-4.73	-183
3	3.72	129	4.44	155	-0.72	-26
4	0.69	21	0.55	18	0.14	3
5	0.14	2	0.03	1	0.11	1
6	0.01	0	0	0	0.01	0

Table 10 shows that gender gaps were most visible at the lower proficiency levels. At Level 1c, 23.61% of males ($n = 831$ of 3,521) performed at this level compared to 16.28% of females ($n = 595$ of 3,655), a gap of 7.33% or 236 more males. At Level 1b, the largest group overall, 35.61% of males ($n = 1{,}253$) and 31.66% of females ($n = 1{,}155$) were recorded, a 3.95% gap or 98 more males. Female students performed better at Level 1a, with 30.74% $(n = 1{,}132)$ compared to 24.65% of males $(n = 872)$, a -6.09% gap or 260 more females. At Level 3, 4.44% of females $(n = 163)$ reached this level compared to 3.72% of males $(n = 137)$, a -0.72% gap or 26 more females. Gender gaps were small at higher levels: Level 4 showed a 0.14% gap (3 more males), and Level 5 showed only one student more in favor of males. No students from either gender reached Level 6.

Table 11
Proficiency-Level Results by Gender across Reasoning

Proficiency Levels	Reasoning					
	Male %	**Male #**	**Female %**	**Female #**	**M-F %**	**M-F #**
1c	26.86	946	19.6	718	7.26	228
1b	33.89	1202	32.21	1191	1.68	11
1a	24.35	862	29.23	1077	-4.88	-215
2	10.42	372	13.84	499	-3.42	-127
3	3.3	116	4.25	150	-0.59	-34
4	0.99	30	0.72	23	0.27	7
5	0.14	4	0.15	4	-0.01	0
6	0.04	1	0.01	0	0.03	1

Table 11 shows gender differences in reasoning proficiency levels. At Level 1c, 22.93% of males ($n = 808$ of 3,525) were recorded compared to 16.21% of females ($n = 593$ of 3,658), a gap of 6.72% or 215 more males. At Level 1b, the largest group overall, 34.92% of males $(n = 1{,}231)$ and 30.52% of females $(n = 1{,}117)$ were observed, a gap of 4.40% or 114 more males. Female students outperformed males at Level 1a, with 30.43% $(n = 1{,}114)$ compared to 24.42% of males $(n = 861)$, a -6.01% gap or 253 more females. At Level 3, 5.03% of females $(n = 184)$ reached this level compared to 3.68% of males $(n = 130)$, a -1.35% gap or 54 more females. Higher proficiency levels showed minimal gaps: Level 4 had 0.12% more males (4 students), and Level 5 showed no difference. No students reached Level 6 in reasoning.

The overall results for the process subscales show a consistent pattern in gender performance across content areas and process skills. Male students were more often found at the lowest level (1c), especially in Employing (26.89%) and Quantity (28.15%). Female students were more represented at Level 1a, particularly in Uncertainty (32.8%) and Interpreting (30.74%). Most students, regardless of gender, clustered at Level 1b, with gender gaps ranging from small to moderate. At Levels 2 and 3, more females were observed in several domains, though differences were generally small and varied by area. At the higher levels (4–6), very few students reached Level 5, and almost none reached Level 6, showing that advanced mathematical proficiency was rarely achieved.

5. Discussion

This section discusses the key findings, organized into three parts: the overall results in mathematics performance, the influence of socioeconomic indicators, and the distribution of proficiency levels across content areas and process subscales.

5.1 Gender Differences in Mathematical Literacy

The results show that, on average, female students performed slightly better than male students across various mathematical content areas and process subscales in the PISA 2022 assessment. These findings align with the OECD (2023) report, which showed that in the Philippines, girls outperformed boys by 14 points, and the proportion of low-performing students was higher among boys than girls. Our findings contrast with previous international results, which show that boys performed better in mathematics in about 95% of the 56 countries analyzed (Gevrek et al., 2020). This is intriguing, as Filipino students show the most significant gender difference in mathematics, favoring girls, followed by similar patterns in Brunei Darussalam, where girls scored 11 points higher, and Malaysia, where girls scored 10 points higher (OECD, 2023). Further research is recommended to explore the factors contributing to this contrary trend in these countries compared to most PISA-participating countries. For the Philippines, this gender gap calls for policy research to identify strategies that better support male students, as underperformance may limit their future opportunities in STEM and impact overall educational equity.

Empirical evidence suggests that PISA mathematics tasks often involve complex word problems that require advanced reading comprehension skills, with students demonstrating higher reading performance performing better in mathematics (Ding & Homer, 2020). Similar patterns of gender differences have been reported, with females performing better than males on mathematics items that require high reading demands, regardless of reading literacy level, while males show an advantage on items with low reading demands (Ajello et al., 2018). Our results showed higher mean scores and moderate effect sizes favoring female students in specific content areas, suggesting the need for further investigation into how these processes may be influenced by their reading proficiency. These examples of empirical evidence suggest that, for Filipino students, task type and item complexity may play a role in observed gender gaps in mathematics performance. From an educational perspective, these findings suggest that future research could investigate the role of reading comprehension in mediating gender differences in mathematics performance.

Male and female students performed similarly in the "space and shape" content area and the "formulating" process subscale, resulting in a statistically non-significant gender gap. The results were inconsistent with the report, which stated that both genders performed similarly well in "space and shape." Still, females generally performed less effectively than males on tasks involving the "formulating" process, specifically those requiring advanced cognitive skills such as problem formulation (Kaiser & Zhu, 2022). The differences in problem formulation skills might vary depending on contextual or cultural factors, such as instructional approaches or curriculum emphasis on spatial reasoning and problem-solving tasks (Olivares et al., 2021). These results indicate the importance of continuing efforts to develop advanced mathematical reasoning and spatial skills equally among both genders. Policy direction may promote inclusive teaching strategies and curricula that ensure all students have equal opportunities to engage with complex problem-solving tasks.

5.2 Socioeconomic Factors and Student Performance in Mathematics

The present study revealed relatively small socioeconomic differences between male and female students. Previous research has shown that individual socioeconomic status (SES) factors consistently influence academic performance in reading and mathematics, though the scope of gender disparities varies by country and assessment period (Early et al., 2019). Similarly, although SES was significantly correlated with mathematics achievement in some contexts, such as Shanghai, its impact on gender-based achievement gaps was minimal, producing only slight changes in performance differences after controlling for SES (Kaiser & Zhu, 2022). Consistent with these findings, our results show that male students have a slight advantage in parental education and occupational status, with only a small difference in home resources. Despite these minor advantages for males, female students outperformed their male counterparts across various mathematics content areas and process subscales. This suggests that the observed differences in parental education, occupational status, and home possessions were relatively small compared with the gender differences observed in mathematics performance. Although early interventions aimed at reducing SES-based inequalities may be beneficial (Joseph et al., 2024), our results suggest that factors beyond SES, such as study habits, self-discipline, and perseverance, may help students overcome the socioeconomic disadvantages that affect their academic performance.

The observed pattern in the present study further shows that female students demonstrated higher mathematics performance across most content areas and process subscales despite the slight advantages of male students in parental education, occupational status, and home resources. This pattern suggests that socioeconomic differences alone may not fully explain the observed gender differences in mathematics performance. Previous research among Filipino secondary school students found that boys generally reported lower levels of academic motivation and achievement and perceived more negative peer attitudes toward learning than girls (King, 2016). Although the present study did not directly examine motivational factors, these findings suggest that non-socioeconomic factors may also be associated with gender differences in academic performance. This indicates the importance of considering both socioeconomic and learner-related factors when examining gender disparities in mathematics achievement.

Boys, particularly in developing countries, face higher risks of absenteeism and dropout, which contribute to weaker mathematics performance and necessitate more substantial efforts to reduce school disengagement (Jere et al., 2022). In contrast, high school-level socioeconomic status is associated with reduced disparities in mathematics performance across all achievement levels (Perry et al., 2022). This is attention-grabbing, as learning gaps and delayed academic progression pose significant challenges to the Philippine basic education system (EDCOM 2, 2025). The report notes that these delays are linked to systemic factors, including limited access to quality early childhood education, widespread malnutrition, and overcrowded classrooms. These findings suggest the need for policy measures that provide targeted support for at-risk students, such as enhanced mentoring, remedial programs, and nutritional interventions. Future research could examine the interplay between socioeconomic factors, gender, and academic outcomes to better understand the mechanisms driving these learning gaps.

5.3 Insights from Proficiency-Level Gaps in Mathematics Learning

The results indicate that male students are concentrated in the lowest proficiency levels (1c and 1b) across content areas and process subscales, suggesting difficulties with fundamental mathematical concepts and processes, including problem comprehension, procedural application, and reasoning. This distribution of low proficiency levels reflects the development of foundational skills (De Bortoli & Underwood, 2025). These skills are necessary for transitioning from basic arithmetic to algebra (Kaiser & Zhu, 2022). Students often excel at interpreting problems but struggle with employing or formulating them, indicating that they can understand scenarios but have difficulty applying concepts (Almarashdi & Jarrah, 2023). The findings may be linked again to delayed academic progression and limited access to Early Childhood Care and Development (ECCD) centers, as reported in EDCOM 2 (2025). A key question, however, is why boys appear to be disproportionately affected by these delays. Contrasting empirical findings suggest that male students can outperform female students in mathematics in specific contexts. Among the highest-performing students, male students demonstrated stronger intentions to pursue math-related studies or careers than female students (Breda et al., 2023). However, this is not the case in the Philippines, indicating that gender differences in mathematics may be influenced by motivation, aspirations, and access to opportunities, and warrant policy-focused research before the country risks losing part of its potential engineering workforce.

On the other hand, only 16% of Filipino students achieved Level 2, and at the intermediate proficiency level, female students remain the most represented. This is far below the OECD average of 69% for mathematics literacy (OECD, 2023). This low performance suggests that most Filipino students struggle to demonstrate basic mathematical competencies, such as applying arithmetic operations, interpreting data, and solving routine problems. Compared to the OECD average, this indicates significant gaps in foundational knowledge and problem-solving skills, which may limit students' ability to progress to higher levels of mathematical thinking. Factors contributing to this outcome may be related to gaps in teacher preparation resulting from workload and challenges in curriculum implementation, which align with observations from the EDCOM 2 (2025) report regarding systemic barriers in the Philippine basic education system. Other scholarly insights suggest that when key competencies are not explicitly included in the curriculum, teachers may struggle to integrate them effectively. For instance, in the 2024–2025 curriculum for Grades 1, 4, and 7, problem posing is neither articulated as a teaching strategy nor as a learning competency. Combined with heavy teaching workloads, this may limit opportunities to develop critical problem-solving and reasoning skills (Vistro-Yu et al., 2025). This gap indicates challenges in the current mathematics education framework, where most female students are placed at mid-level proficiency, while males are at lower levels. This suggests they have developed skills such as designing simple problem-solving strategies, analyzing basic functional relationships, and interpreting information across mathematical concepts, but still lack the skills to excel at a higher proficiency level.

Male students show a slight advantage at higher proficiency levels (Levels 4-6). Levels 5 and 6 consistently demonstrate advanced mathematical thinking, solving abstract and complex problems through flexible reasoning (De Bortoli & Underwood, 2025). Historically, fewer than 20% of students have achieved this level (Kusmaryono & Kusumaningsih, 2023). However, the percentage of Filipino students reaching this level is negligible (less than 0.06%), and the observed gender differences may only reflect natural intelligence rather than be statistically attributable to the effects of curriculum or systemic support. The observation that only a few students reached Level 6—three in Formulating (two males, one female) and only one male in Reasoning, with no students achieving the highest level in other competencies—suggests that the education system may not fully support the development of intelligent students. The reversal findings at the higher level, favoring Filipino male students, conform to the global trend, where male students (approximately 60%) typically outperform female students and exhibit higher math self-efficacy (Keller et al., 2022). However, globally, students struggled at proficiency levels 5 and 6, with only 5% at level 5 and 2% at level 6 (Almarashdi & Jarrah, 2023). This pattern appears attenuated by contextual factors that remain to be fully identified through further research. Policy recommendations can be drawn from empirical evidence reported in scholarly works, such as implementing a cognitive layered framework that aligns teaching techniques with students' reasoning levels (Srivani & Abirami, 2024) or providing cognitive training for potentially gifted children (de Vreeze-Westgeest & Vogelaar, 2022). While such approaches may have been piloted in select Philippine classrooms, the persistent lagging results in PISA suggest a need to reevaluate their implementation and the supporting structures to promote their effectiveness.

6. Conclusion

This study employed a quantitative approach to examine gender disparities, socioeconomic backgrounds, and proficiency-level patterns in mathematics performance among Filipino students. Using secondary data from the 2022 OECD PISA assessment, the analysis examined differences across mathematical content areas and process subscales, as well as the distribution of students across proficiency levels. We present important findings regarding gender and proficiency-level gaps, discussing their implications for educational policy, including targeted interventions, inclusive teaching strategies, and evidence-based actions that may help address learning disparities and improve mathematics performance.

Important findings reveal that Filipino female students outperformed male students across most mathematics content areas and process subscales in the PISA 2022 assessment, contrasting with global trends where males generally excel. Male students were disproportionately concentrated in lower proficiency levels, struggling with fundamental mathematical concepts, problem comprehension, and reasoning, while females were more represented at intermediate levels. Most Filipino students remain at the lower to intermediate proficiency levels, with female students more defined at the intermediate stage.

Overall, mathematics performance in the Philippines lags behind international standards, indicating that many students struggle with fundamental skills, including basic arithmetic, data interpretation, and routine problem-solving. Task characteristics, such as high reading demands, may partly explain these gender differences, alongside contextual factors like instructional approaches and curriculum emphasis. Male students showed slight advantages in parental education, occupational status, and home resources. However, these socioeconomic advantages did not correspond to higher mathematics performance among male students. Across proficiency levels, very few students demonstrated advanced mathematical thinking, suggesting systemic challenges in the Philippine education system, including delayed academic progression, limited access to early childhood education, and excessive teacher workloads.

These findings carry important implications for policy and practice in the Philippine education system. At the policy level, the lower performance of male students and their greater concentration in the lower proficiency levels suggest the need for gender-responsive interventions that address disengagement, absenteeism, and persistent learning difficulties in mathematics. The predominance of students in lower to intermediate proficiency levels also highlights the need to strengthen foundational numeracy skills in the early years of schooling to prevent learning gaps from widening across grade levels. At the practice level, students' difficulties in reasoning, problem comprehension, and reading-intensive mathematics tasks indicate the need to integrate reading support within mathematics instruction and provide more structured opportunities for problem-solving and mathematical reasoning. Teachers may also need to provide closer monitoring and targeted assistance to learners who are at risk of falling behind, particularly male students. These findings can inform DepEd reform efforts by guiding the refinement of curriculum content, strengthening instructional approaches that promote conceptual understanding and real-world application, and improving assessment practices to better measure reasoning and higher-order thinking skills. Such actions may help reduce performance gaps and improve mathematics achievement among Filipino learners.

Conflict of Interest Statement

The author declares that there are no relevant financial or non-financial competing interests to report.

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