Gender Difference in Mathematical Reasoning and Academic Performance Among Junior High School Students

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Abstract- ***The study was conducted to determine if there was any significant relationship between the level of mathematical reasoning and academic performance among junior high school students; if there was any significant difference in the level of mathematical reasoning among gender; and lastly if there was any significant difference in the level of academic performance among gender. The researcher used the descriptive method and the appropriate statistical tools were utilized to treat the gather data. This research considered the gender variation in mathematical reasoning and academic achievement of Junior High School students. The results showed that female students demonstrated strong proficiency in systematic problem-solving, identifying errors, and abstract mathematical concepts. Female students lacked confidence in problem-solving related to fractions, percentages, algebra, and the application of mathematics to actual situations. Male students, however, were good at systematic problem-solving, recognizing errors and establishing general principles but were a bit less confident in abstract thinking and application. The findings also uncovered that male students consistently surpassed female students in total academic achievement by a higher percentage obtaining outstanding marks, while female students showed more dispersed distribution in their performance. Statistical analyses certified the existence of a moderate and significant positive correlation between mathematical reasoning and academic performance. The data also proved significantly high on both mathematical reasoning and academic performance across male and female students, while males performed at higher levels for both mathematical reasoning and academic achievement. The research emphasized the need for targeted interventions to improve mathematical reasoning and confidence among female students to narrow the identified performance gap. According to these results, the study suggested that remedial classes and physical training as targeted interventions to build confidence in problem-solving with easy mathematical exercises among female students. Gender-responsive pedagogies should also be developed to facilitate male students' abstractness and female students' practical skills. Schools were encouraged to put more emphasis on logical reasoning and problem-solving in general to enhance the overall performance of students. Teachers should employ inclusive teaching methods that embrace multiple learning modalities to ensure equal access to mathematical and academic advancement for both males and females. Subsequent research needs to examine other gender determinants of mathematical reasoning and academic achievement, including instructional approaches, learning environments, and socio-cultural influences.***

I. INTRODUCTION

Mathematics is one of the fundamental entities of the school system, responsible for providing the foundation for intellectual growth and solving problems. However, whether gender affects mathematical thought and the performance at school still remains one of the famous issues that have been persistently discussed in educational research. During the junior high school period, which is considered to be a critical stage of intellectual development, proper understanding of any possible gender differences in the mathematical abilities and performances of boys or girls may help explain why boys or girls tend to approach and excel in this subject (Villalon et al., 2024).

In mixed findings have been reported in the history of research into gender differences in mathematics. Some authors reported that boys are better than girls especially in mathematical reasoning tasks. Others report no difference, but superiority or much better performance on the part of girls in some aspects such as computation and even verbal reasoning. Once again, variations in these differences are brought about by a number of elements which include but are not limited to cognitive abilities, classroom dynamics, societal expectations, and even levels of math anxiety-all of these factors may take different effects on male and female students. For the junior high school years, these differences may actually be more apparent because students are increasingly faced with demanding mathematical concepts while yet forming a strong sense of self as far as their aptitude in the subject is concerned.

Gender differences in mathematics have been a pertinent topic for research that goes beyond mere measurement of performance but relates closely to how such stereotypes and expectations and cultural norms determine the attitudes and level of confidence adopted by students toward the subject. For example, girls may internalize messages about math being a game for males and so get negatively impact both by performance and participation in mathematics-related activities. Boys may receive more encouragement to perform well in mathematics, pumping up their confidence and producing better outcomes in problem-solving tasks (Ellemers, 2018).

This paper aims to determine the degree of gender difference in both mathematical reasoning and academic performance among junior high school students. These are identified by educators and policymakers to make targeted interventions to ensure that boys and girls have the same opportunities for succeeding in mathematics. Such intervention is necessary for advancing gender equality in education because it guarantees a generation of students confident in their mathematical ability, irrespective of gender.

Junior High School students focusing more in studying, like most of them spend a time in classroom, in library, in cellphone for searching things and in every place that help them to get a high grades. Education is a key to success. The efforts and skills of every student improve by knowing their abilities in answering the equations.

Mathematical reasoning is one of the most important cognitive skills for achieving general academic success and creating future opportunities for further education and employment. Generally, it is expected that academic performances in mathematics set up students' education trajectories individually at a great extent. Despite this, there has been a lot of debate for a long time about how much of the variation in mathematical reasoning and performance actually is traced back to gender differences. Studies showed that traditional gender roles and societal expectations influenced how students approached mathematics, with males often stereotypically viewed as more proficient in the subject (Xie & Liu, 2023). However, these perceptions failed to fully reflect the experiences of both female and male students, who faced unique challenges in mathematical reasoning. By broadening the focus to include all gender identities, it was possible to gain a more inclusive and equitable understanding of how gender diversity affected mathematical performance and reasoning.

Societal and cultural influences have traditionally dictated education differences between males and females in a way of either male or female dominance of mathematical skills. Previous researches indicated large boys' advantages for mathematical activities. Recent studies imply a more differentiated picture—such that gender variations in mathematics are less extreme and more contextually dependent than it was thought previously (Wulandari, Gunadi, & Runisah, 2025). These findings have attracted researchers' attention to understand the concept of gender as an influence on mathematical reasoning and academic achievement in junior high school students, especially with students' interest in mathematics increasing every year. Studying this area not only benefits one's fellow students, but it also confirms the faith that, irrespective of gender, everyone has an equal capacity. The more engaged the students are, the deeper their learning and the more confidence they have to solve more complicated mathematical problems.

The study determined the extent of gender differences in mathematical reasoning and academic performance among junior high school students. Specifically, it answers the following questions.

1. What is the level of mathematical reasoning among junior high school students?
2. What is the level of academic performance among junior high school students?
3. Is there any significant relationship between the level of mathematical reasoning and academic performance among junior high school students?
4. Is there any significant difference in the level of mathematical reasoning among gender?
5. Is there any significant difference in the level of academic performance among gender?

Thus, the researcher's hypothesis predicts the following:

1. There is no significant relationship between the level of mathematical reasoning and the level of academic performance among junior high school students.
2. There is no significant difference in the level of mathematical reasoning among gender.
3. There is no significant difference in the level of academic performance among gender.

II. METHODOLOGY

Research Design

The study entitled "Gender Differences in Mathematical Reasoning and Academic Performance among Junior High School Students" was a descriptive research. Descriptive research was used to obtain information concerning the current status to describe "what exists" with respect to the variables (McCombes, 2019). The researcher used the descriptive correlation method; this method was used to gather the data needed and test the relationship between two variables and interconnected to one another. It was the best research design because it dealt with observation and documentation of differences as they existed between males and females. This way, the study observed and measured mathematical reasoning and academic performance without manipulating variables. It facilitated the accumulation of quantified data like the test scores, thereby comparison and classification of the obtained results with respect to the gender factor, for greater details in the identified differences. The study's focus was not on testing intervention, so descriptive research presented a viable and reliable methodological approach toward the desired result.

Quantitative research referred to data present in numeric form. When collected using a primary method, it used statistical data collected by means of a questionnaire. The purpose of quantitative research was to emphasize the collection of objective data in order to assess a social phenomenon, (Apuke, 2017).

Participants and Sampling Procedure

The study population had been purposively selected junior high school students in nine public secondary schools of the Division of Laguna. These were selected to ensure a varied and sizable population of students across various municipalities. 200 respondents had been proportionally sampled from the total combined population of 10,763 junior high school students, with stratified random sampling to ensure an equitable representation from each school.

Research Instrument

The researcher used self-made questionnaire to get information about the level of mathematical reasoning and academic performance among junior high school students. The questionnaire was composed of two (2) sets. The first part was the level of mathematical reasoning and the third part was the level of academic performance that had an overall total of 20 items. Indeed, as noted by Taherdoost (2016), questionnaires that are either self-created or designed by researchers are frequently constructed to guarantee that the tool is specifically adapted to the study's context and closely aligns with the research goals. This approach enables researchers to personalize the questions according to the variables they aim to assess, particularly in situations where a standardized instrument is not accessible for the particular research environment.

Data Procedure

The data were tailed, tabulated and interpreted using the numeric values assigned to the quantitative descriptions used in the questionnaire. The statistical treatment was used in order to answer the specific question of the study. The levels of mathematical reasoning were computed using weighted mean, verbal interpretation and rank. Frequency, percentage and rank were used to test the level of academic performance in mathematics among junior high

school students. Spearman's Rank Correlation was used to test the relationship between the level of mathematical reasoning and academic performance in mathematics among junior high school students. In testing the significant difference in the level of mathematical reasoning and academic performance based on gender, Independent T-test were used.

III. RESULTS AND DISCUSSIONS

Table 1. Level of Mathematical Reasoning among Junior High School Students

I can…	Female			Male		
	WM	VI	Rank	WM	VI	Rank
1. use systematic steps in solving mathematical equations	3.41	Strongly Agree	1	3.62	Strongly Agree	1
2. possess the reasoning ability pertaining to complex mathematical concepts	3.25	Strongly Agree	8	3.45	Strongly Agree	5.5
3. assess my reasoning processes through discussions or peer reviews	3.27	Strongly Agree	5.5	3.46	Strongly Agree	4
4. explain concepts and solve problems that require different areas of mathematics	3.27	Strongly Agree	5.5	3.45	Strongly Agree	5.5
5. formulate general principles or rules based on specific examples.	3.28	Strongly Agree	4	3.48	Strongly Agree	3
6. identify mistakes in mathematical work and connect them.	3.31	Strongly Agree	2.5	3.55	Strongly Agree	2
7. apply mathematical concepts to real-life situations and shows my practical reasoning skills.	3.25	Strongly Agree	8	3.35	Strongly Agree	9
8. understand and solve abstract mathematical concepts.	3.31	Strongly Agree	2.5	3.33	Strongly Agree	10
9. use mathematical reasoning to solve problems involving fractions, percentages, and algebra effectively.	3.23	Agree	10	3.44	Strongly Agree	7
10. relate and connect different mathematical concepts across various domains (e.g., geometry, algebra, statistics)	3.25	Strongly Agree	8	3.42	Strongly Agree	8
General Weighted Mean	3.29	Strongly Agree		3.45	Strongly Agree	

The female respondents demonstrated a strong proficiency in several areas of mathematics, with their strengths using systematic steps in solving equations, the ability to identify mistakes and understand their connections, and a strong grasp of abstract mathematical concepts. These suggested

confidence in structured problem-solving, reflection, and deep theoretical understanding. However, there were few areas for improvement. Their ability to use mathematical reasoning to solve problems involving fractions, percentages, and algebra were least observed, indicating that the individual might feel less confident with practical, foundational mathematical tasks. Additionally, while the individual performed well in understanding abstract concepts, they rated somewhat lower in applying these mathematical principles to real-life situations and demonstrating practical reasoning skills, which suggested a gap between theoretical knowledge and real-world application.

The male respondents perceived that their best skills of mathematical proficiency were reflected in the ability to use systematic steps in solving mathematical equations, identifying mistakes in mathematical work and connecting them and formulating general principles or rules based on specific examples. These indicated that they were not only effective in solving equations but also in reflecting on their own work and drawing generalizable conclusions from specific instances.

Moreover, they were slightly less confidence in the ability to understand and solve abstract mathematical concepts. Similarly, applying mathematical concepts to real-life situations and demonstrating practical reasoning skills slightly close to it. These indicated that opportunities for further development in applying mathematical concepts practically and understanding abstract theories more deeply. In line with this is the study of Wang et al. (2020) found out that boys generally outperformed girls in tasks that required spatial reasoning and advanced problem-solving skills and it also highlighted that societal expectations and classroom experiences significantly influence students' confidence and interest in mathematics.

Table 2. Level of Aca demic Performance among Junior High School Students

Performance	Female			Male		
	Frequency	Percent	Rank	Frequency	Percent	Rank
Outstanding	26	26.26	1.5	60	59.41	1
Very Satisfactory	12	12.12	4	8	7.92	4
Satisfactory	26	26.26	1.5	13	12.87	3
Fairly Satisfactory	10	10.10	5	6	5.94	5
Poor	25	25.25	3	14	13.86	2
Total	99	100.00		101	100.00	

Female students showed an outstanding performance, although males had an even higher proportion, making this category the most common for them. In the very satisfactory level, more females were rated as such compared to males. In the poor level of performance, more females were rated poorly compared to males.

Generally, female students had a more dispersed distribution across levels of performance, with outstanding and satisfactory sharing the top. Male students, on the other hand, had a clearer distinction, with outstanding taking the top rank. Overall, while males performed better in the outstanding level, females showed a more varied performance across the field.

Reflecting this was the study of Hidayatullah & Csíkos (2023) found out that male students tended to have stronger beliefs in their mathematical abilities than female students. This confidence might contribute to their higher academic performance, as reflected in the results of this study, where male students performed significantly better in the outstanding category.

Moreover, these findings suggest that fostering confidence in female students regarding their mathematical abilities may play a crucial role in bridging the performance gap. Schools and educators can implement strategies such as mentorship programs, positive reinforcement, and interactive

learning methods to boost female students' self-perception in mathematics.

Table 4. Test of Relationship between the Level of Mathematical Reasoning and Academic Performance among Junior High School Students

Variables	r_s-value	p-value	Relationship
Level of Mathematical Reasoning and Academic Performance	0.28	<0.0001	Highly Significant

The results of a test examining the relationship between the level of mathematical reasoning and academic performance among Junior High School students, revealed a moderate, but significant, positive relationship between students' mathematical reasoning abilities and their academic performance.

This implied that stronger mathematical reasoning skills were likely associated with better overall academic outcomes. Thus, as students' ability in mathematical reasoning increased, their overall academic performance tended to improve as well.

Spatial reasoning was consistently linked to mathematics proficiency and discussed the unique contributions of different spatial reasoning constructs (mental rotation, spatial visualization, and spatial orientation) to mathematics performance for females and males in general and across different mathematical content; geometry-measurement and number sense, (Harris et.al., 2021).

Table 5. Test Difference in the Level of Mathematical Reasoning based on Gender

Variables	Gender	Mean	t-value	p-value	Difference
Level of Mathematical Reasoning	Female	3.29	2.60	0.0100	Highly Significant
	Male	3.45			

The result of a test that analyzed the difference in the level of mathematical reasoning between female and male Junior High School students revealed a highly significant difference in the level of mathematical reasoning between female and male students, with male students demonstrating a higher average level of reasoning.

This suggested that the gap between male and female students in mathematical reasoning was meaningful and not a result of random variation. The difference in mathematical reasoning between genders pointed to the potential influence of both social and educational factors in shaping cognitive abilities. This finding emphasized the need for further research into how gender dynamics might affect learning outcomes in mathematics.

Parallel to this is the study of Lestari (2019) proved empirical evidence wherein the reasoning capacity of junior high school students was different quite extensively and could be influenced by instructional methods, such as problem-solving versus traditional teaching. While gender was not investigated directly in this study, the evidence showed that differences in reasoning capacity were not random but systematic. This suggested gender differences in mathematical reasoning to be important and potentially a consequence of educational practices, socio-cultural forces, or intrinsic factors like confidence.

Table 6. Test Difference in the Level of Academic Performance based on Gender

Variables	Gender	Mean	t-value	p-value	Difference
Academic Performance	Female	82.76	4.75	<0.0001	Highly Significant
	Male	89.87			

The results for the test of difference in academic performance between female and male Junior High School students, was highly significant. Likewise, the difference was highly significant, emphasizing that the gap between male and female students' academic performance was strong.

This indicated that, on average, male students performed better academically than female students. The data reflected gender differences in academic performance, where males tended to excel in the highest category, while females displayed a broader range of performance outcomes.

The finding was aligned with Capuno et al. (2019) offered proof that gender differences in academic achievement, e.g., male students performing better in subjects like mathematics, were not solely driven by inherent ability but also by differing learning experiences and dispositions. The evidence lent weight to the idea that gendered factors, influenced by education and societal settings, explained why males tended to perform better than females in some areas of study. This approach provided a more in-depth look at how differences in gendered achievement emerged within educational environments.

CONCLUSION

In view of findings, the following conclusions were drawn:

1. The study revealed strong correlation between mathematical reasoning and academic performance, and the inference was that those students who score better on tests of reasoning would be better academically performed.
2. There was a high variation in mathematical reasoning based on gender, where males had better abilities compared to females. This suggests the need for gender-sensitive instructional strategies to guide female students to improve their mathematical reasoning capabilities.
3. The study revealed that male students outperform female students academically on average. This disparity suggests the influence of both educational and social factors, emphasizing the need for targeted interventions and an inclusive learning environment to ensure equal academic opportunities for both genders.

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