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Teaching Methods in Mathematics on the Students' Attitudes, Self-Efficacy, and Cognitive Abilities

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Abstract*—The study aimed to determine the relationship and effects of teaching methods in Mathematics on the students' attitudes, self-efficacy, and cognitive abilities. Specifically, it sought to identify the levels of teaching methods in Mathematics, students' attitudes, self-efficacy, and cognitive abilities, and to examine the significant relationships and effects among these variables. A quantitative predictive-correlational design was used involving 103 Humanities and Social Sciences students from the Philippine Women's University–CDCEC Santa Cruz, selected through purposive sampling. Data were gathered using a validated survey questionnaire and a researcher-developed cognitive ability test. Descriptive statistics, such as the weighted mean and standard deviation, were used to determine the levels of teaching methods, students' attitudes, and self-efficacy, while frequency and percentage were used for cognitive ability. Additionally, to examine relationships and effects among variables, Pearson product-moment correlation and multiple regression analyses were employed. Findings revealed that the level of teaching methods in mathematics, students' attitudes, and self-efficacy were very high across all dimensions, while the level of students' cognitive abilities was very satisfactory. Furthermore, there is a significant relationship between teaching methods in Mathematics and students' attitudes and self-efficacy, but no significant effect of these methods on students' cognitive abilities. The study concludes that the null hypotheses stating that there is no significant relationship between teaching methods in Mathematics and students' attitudes and self-efficacy are rejected. Conversely, the null hypothesis stating that there is no significant effect of teaching methods on students' cognitive abilities is accepted. It is therefore recommended that teachers integrate higher-order thinking tasks, problem-solving activities, and metacognitive strategies into activity-based, heuristic, and analytic teaching methods to enhance students' cognitive development. Students are encouraged to engage in independent learning and practice to strengthen their cognitive skills beyond classroom instruction. Additionally, future researchers may investigate the topic using larger samples and more rigorous research designs.*

***Keywords*—** *Teaching Methods in Mathematics, Students' Attitudes, Students' Self-Efficacy, and Students' Cognitive Abilities.*

I. INTRODUCTION

Mathematics education goes beyond the transmission of knowledge. It molds students' attitudes, confidence, and thinking skills. Teaching methods are crucial in how students understand mathematical concepts, develop problem-solving abilities, and view themselves as learners. Learner-centered approaches such as activity-based, heuristic, and analytic methods are commonly used to improve learning outcomes. These approaches promote hands-on learning, exploration, and logical reasoning, helping students understand lessons more effectively and participate actively.

Students' attitudes toward mathematics, self-efficacy, and cognitive abilities are essential for successful learning. A positive attitude increases engagement, while self-efficacy strengthens motivation and persistence. Cognitive abilities such as reasoning and problem-solving are necessary for understanding and applying mathematical concepts. Research shows that students with higher self-efficacy perform better and are more likely to persist in challenging tasks (Zhao and Ma, 2025).

The importance of learner-centered instruction is supported by the Department of Education through DepEd Order No. 8, s. 2015 and DepEd Order No. 42, s. 2016. These policies promote constructivist and performance-based approaches that emphasize critical thinking and real-life application of knowledge, shifting away from traditional memorization toward meaningful learning.

Recent studies further show that learner-centered teaching strategies enhance students' engagement and academic performance. Active involvement in learning has a strong positive effect on achievement (Sahito, 2025), while student-centered approaches improve both performance and problem-solving skills in mathematics (Islam et al., 2024).

Despite this, traditional methods focused on memorization remain common, limiting students' engagement and higher-order thinking. This highlights the need to examine how teaching methods are related to students' attitudes, self-efficacy, and cognitive abilities. Thus, this study aims to determine the relationship and effects of activity-based, heuristic, and analytic teaching methods on these factors in mathematics.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to determine the relationship and effects of teaching methods in Mathematics on the students' attitudes, self-efficacy, and cognitive abilities.

Specifically, it sought to answer the following questions:

1. What is the level of Teaching Methods in Mathematics in terms of:
   1.1. Activity-Based Method;
   1.2. Heuristic Method; and
   1.3. Analytic Method?
2. What is the level of Students' Attitudes in terms of:
   2.1. Openness to Learning;
   2.2. Enjoyment; and
   2.3. Willingness to Participate?

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3. What is the level of Students' Self-Efficacy in terms of:
   3.1. Competence;
   3.2. Persistence; and
   3.3. Self-Regulated Learning?
4. What is the level of Students' Cognitive Abilities in terms of:
   4.1. Memory Ability;
   4.2. Information Processing Ability;
   4.3. Logical Reasoning Ability;
   4.4. Representational Ability?
5. Is there a significant relationship between the Teaching Methods in Mathematics and Students' Attitudes?
6. Is there a significant relationship between the Teaching Methods in Mathematics and Students' Self-efficacy?
7. Is there a significant effect between the Teaching Methods in Mathematics on Students' Cognitive Abilities?

II. METHODOLOGY

A quantitative predictive-correlational design was used involving 103 Humanities and Social Sciences students from the Philippine Women's University–CDCEC Santa Cruz, selected through purposive sampling. Data were gathered using a validated survey questionnaire and a researcher-developed cognitive ability test. Descriptive statistics, such as the weighted mean and standard deviation, were used to determine the levels of teaching methods, students' attitudes, and self-efficacy, while frequency and percentage were used for cognitive ability. Additionally, to examine relationships and effects among variables, Pearson product-moment correlation and multiple regression analyses were employed.

III. RESULTS AND DISCUSSION

This part presents, analyzes, and interprets data on the relationship and effects of teaching methods in Mathematics on students' attitudes, self-efficacy, and cognitive abilities. The results are organized according to the statement of the problem and are presented using appropriate statistical tools and tables. Findings from this chapter serve as the basis for the conclusions and recommendations in the succeeding chapter.

Level of Teaching Methods in Mathematics

In this study, the level of Teaching Methods in Mathematics includes activity-based, heuristic, and analytic methods.

The level of teaching methods was revealed in the following table, which shows the statement, mean, standard deviation, remarks, and verbal interpretation.

Table 1 shows the level of teaching methods in Mathematics with respect to the activity-based method. My mathematics teacher allows students to practice and demonstrate mathematical skills by actively participating in learning activities (M=4.49, SD=0.70) gained the highest mean score and was marked as Strongly Agree.

On the other hand, although it was also interpreted as Strongly Agree, my mathematics teacher assess student performance by observing participation and outputs during classroom activities (M=4.39, SD=0.84), received the lowest mean score.

Table 1. Level of Teaching Methods in Mathematics in Terms of Activity-Based Method

Statements My mathematics teacher uses methods that…	Mean	SD	Remarks
…help students connect prior knowledge through structured learning activities before introducing new lessons	4.44	0.62	Strongly Agree
…introduce new mathematical concepts using hands-on tasks and guided classroom activities.	4.46	0.64	Strongly Agree
…allows students to practice and demonstrate mathematical skills by actively participating in learning activities.	4.49	0.70	Strongly Agree
…require students to analyze and discuss solutions from the group activity	4.42	0.59	Strongly Agree
…assess student performance by observing participation and outputs during classroom activities.	4.39	0.84	Strongly Agree
Weighted Mean	4.44		
SD	0.68		
Verbal Interpretation	Very High		

Overall, the weighted mean of 4.44 with a standard deviation of 0.68 indicates a Very High level of activity-based teaching methods in mathematics instruction. This result implies that hands-on tasks, collaborative discussions, and structured learning activities, which are activity-based strategies, are commonly practiced in the classroom.

In summary, the findings highlight the importance of activity-based teaching in facilitating meaningful mathematics learning. Engaging students in interactive, participatory tasks promotes deeper understanding of mathematical concepts and encourages active involvement in the learning process.

Table 2 presents the level of teaching methods in Mathematics with respect to the heuristic method. My mathematics teacher uses method that encourage students to recall previous lessons through guided questions acquired the highest mean score (M=4.55, SD=0.61), interpreted as Strongly Agree.

Meanwhile, my mathematics teacher uses method that help students understand mathematical concepts by discovering ideas on their own obtained the lowest mean score (M=4.37, SD=0.73) despite being interpreted as Strongly Agree.

Table 2. Level of Teaching Methods in Mathematics in Terms of Heuristic Method

Statements My mathematics teacher uses methods that…	Mean	SD	Remarks
…encourage students to recall previous lessons through guided questions.	4.55	0.61	Strongly Agree
…help students understand mathematical concepts by discovering ideas on their own.	4.37	0.73	Strongly Agree
...engage students in critical thinking through questioning and exploration during lessons.	4.47	0.74	Strongly Agree
…ask students to explain and justify their solutions using clear reasoning.	4.52	0.56	Strongly Agree
…guide students in developing their own problem-solving strategies through discovery activities.	4.49	0.65	Strongly Agree
Weighted Mean	4.48		
SD	0.66		
Verbal Interpretation	Very High		

Altogether, the weighted mean of 4.48 and the standard deviation of 0.66 show that the heuristic method in

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mathematics instruction is at a Very High level. The results denote that teacher guidance through questioning, exploration, and problem-solving, which are heuristic strategies, is constantly incorporated into classroom procedures.

Generally, the findings emphasize that the heuristic teaching method enhances students' analytical thinking and problem-solving skills. By encouraging learners to explore different strategies and explain their reasoning, the teacher supports the development of deeper mathematical understanding. This approach also promotes active participation in classroom discussions and helps students become more engaged and confident in solving math problems. It also cultivates students' ability to think independently and apply learned concepts to real-life situations.

Level of Teaching Methods in Mathematics in Terms of Analytic Method

Table 3 illustrates the level of teaching methods in Mathematics with respect to the analytic method. My mathematics teacher explains mathematical ideas clearly using step-by-step demonstrations and discussions yielded the highest mean score (M=4.49, SD=0.68), interpreted as Strongly Agree. In contrast, also interpreted as Strongly Agree, my mathematics teacher uses method that assess student answers based on accuracy, logic, and correctness of procedures got the lowest mean score (M = 4.26, SD = 0.80).

Table 3. Level of Teaching Methods in Mathematics in Terms of Analytic Method

Statements My mathematics teacher uses methods that…	Mean	SD	Remarks
…review basic concepts by discussing definitions, rules, and examples before new lessons.	4.43	0.68	Strongly Agree
…explain mathematical ideas clearly using step-by-step demonstrations and discussions.	4.49	0.68	Strongly Agree
…emphasize logical thinking and systematic problem-solving during mathematics lessons.	4.34	0.72	Strongly Agree
…assess student answers based on accuracy, logic, and correctness of procedures.	4.26	0.80	Strongly Agree
…guide students in forming conclusions or solutions using logical reasoning.	4.40	0.68	Strongly Agree
Weighted Mean	4.38		
SD	0.71		
Verbal Interpretation	Very High		

The weighted mean of 4.38 with a standard deviation of 0.71 indicates a Very High level of the analytic method in mathematics instruction. This implies that analytical strategies, such as explaining concepts through structured steps, reviewing fundamental rules, and guiding students toward logical conclusions, are frequently applied in the classroom.

Collectively, the findings show that the analytic method helps students develop logical thinking and step-by-step problem-solving skills in mathematics. Clear explanations and organized examples also help them understand concepts and apply them correctly.

Level of Students' Attitudes

The level of students' attitudes was evaluated using three indicators: openness to learning, enjoyment, and willingness to participate. The results are presented in the following table, which shows the statements, means, standard deviations, remarks, and verbal interpretations.

Table 4 demonstrates the level of students' attitude in mathematics in terms of openness to learning. As a student in Mathematics class, I recognize previously learned concepts when new topics are introduced gained the highest mean score (M = 4.47, SD = 0.64), interpreted as Strongly Agree.

Table 4. Level of Students' Attitude in Terms of Openness to Learning

Statements As a student in mathematics class I…	Mean	SD	Remarks
…recognize previously learned concepts when new topics are introduced.	4.47	0.64	Strongly Agree
…use different strategies to solve complicated mathematical problems.	4.31	0.74	Strongly Agree
…explain my understanding of new mathematics topics using my own words.	4.32	0.77	Strongly Agree
…analyze and review my mistakes to improve future performance.	4.42	0.75	Strongly Agree
…try new ways of learning when lessons become challenging.	4.28	0.73	Strongly Agree
Weighted Mean	4.36		
SD	0.73		
Verbal Interpretation	Very High		

Moreover, as a student in Mathematics class, I try new ways of learning when lessons become challenging received the lowest mean score (M = 4.28, SD = 0.73), which is also interpreted as Strongly Agree.

The overall weighted mean of 4.36 with a standard deviation of 0.73 indicates a Very High level of students' openness to learning in mathematics. This denotes that students display a positive attitude towards learning.

In conclusion, the results emphasize that students are open and willing to learn mathematics. They connect information to what they already know, learn from their mistakes, and explain their own mathematical ideas. This shows a positive mindset that helps them improve in the subject.

Level of Students' Attitude in Terms of Enjoyment

Table 5 exhibits the level of students' attitude in mathematics in terms of enjoyment. As a student in mathematics class, I show interest and enthusiasm when participating in math class acquired the highest mean score (M = 4.50, SD = 0.64), interpreted as Strongly Agree.

However, although it was still interpreted as Strongly Agree, as a student in mathematics class, I reflect on how much I enjoy learning during math lesson obtained the lowest mean score (M = 4.21, SD = 0.86).

Table 5. Level of Students' Attitude in Terms of Enjoyment

Statements As a student in mathematics class I…	Mean	SD	Remarks
…recall enjoyable learning experiences during mathematics lessons.	4.35	0.74	Strongly Agree
…appreciate the activities used to help me understand mathematics concepts.	4.36	0.75	Strongly Agree
…show interest and enthusiasm when participating in math class.	4.50	0.64	Strongly Agree
…reflect on how much I enjoy learning	4.21	0.86	Strongly

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during math lessons.			Agree
…experience positive learning experiences while doing math tasks.	4.32	0.73	Strongly Agree
Weighted Mean	4.35		
SD	0.74		
Verbal Interpretation	Very High		

All in all, the weighted mean of 4.35 with a standard deviation of 0.74 indicates a Very High level of enjoyment in learning mathematics. This result implies that students enjoy their math classes and value the activities that help them better understand mathematical concepts.

To sum up, the findings highlight that students have a positive attitude toward mathematics, as evidenced by their enthusiasm, appreciation for learning activities, and positive experiences during mathematical tasks. This enjoyment may support increased motivation and constant engagement in learning mathematics.

Table 6 shows the level of students' attitude in mathematics in terms of willingness to participate. As a student in mathematics class, I take opportunities to actively participate in classroom activities yielded the highest mean score (M = 4.36, SD = 0.74), interpreted as Strongly Agree.

On the other hand, as a student in mathematics class I assess my level of participation during activities got the lowest mean score (M = 4.21, SD = 0.90), although it was interpreted as Strongly Agree.

Table 6. Level of Students' Attitude in Terms of Willingness to Participate

Statements As a student in mathematics class I…	Mean	SD	Remarks
…take opportunities to actively participate in classroom activities.	4.36	0.74	Strongly Agree
…express my ideas during mathematics discussions.	4.24	0.73	Strongly Agree
…contribute meaningfully to group activities during math lessons.	4.28	0.78	Strongly Agree
…examine problems before sharing my responses.	4.26	0.75	Strongly Agree
…assess my level of participation during activities	4.21	0.90	Strongly Agree
Weighted Mean	4.27		
SD	0.78		
Verbal Interpretation	Very High		

Overall, the weighted mean of 4.27 with a standard deviation of 0.78 indicates a Very High level of students' willingness to participate in mathematics learning activities. This denotes that students have a positive attitude toward engaging in classroom discussions, exchanging ideas, and contributing to collaborative tasks.

In summary, the findings emphasize that students participate actively in class. Their willingness to share ideas, analyze problems before responding, and help with group activities reflects a supportive learning environment that promotes participation, interaction, and communication throughout mathematics classes.

Level of Students' Self-Efficacy

The students' attitudes were measured through openness to learning, enjoyment, and willingness to participate. The results are shown in the table below, which includes the statements, mean, standard deviation, remarks, and corresponding verbal interpretations.

Table 7 presents the level of students' self-efficacy in mathematics in terms of competence. As a student in mathematics class, I retrieve relevant formulas, rules, and procedures needed to solve mathematical problems gained the highest mean score (M = 4.44, SD = 0.70), interpreted as Strongly Agree.

Meanwhile, while still interpreted as Strongly Agree, as a student in mathematics class, I check and review my solutions to ensure accuracy receive the lowest mean score (M = 4.27, SD = 0.77).

Altogether, the weighted mean of 4.33, with a standard deviation of 0.77, indicates a Very High level of students' self-efficacy in terms of mathematical competence. This implies that students believe in their capabilities to apply mathematical concepts, analyze problems, and formulate proper solutions.

Table 7. Level of Students' Self-Efficacy in Terms of Competence

Statements As a student in mathematics class I…	Mean	SD	Remarks
…retrieve relevant formulas, rules, and procedures needed to solve mathematical problems.	4.44	0.70	Strongly Agree
…use learned mathematical concepts to solve problems correctly.	4.33	0.78	Strongly Agree
…analyze problems to determine the correct method needed for a solution.	4.28	0.76	Strongly Agree
…check and review my solutions to ensure accuracy.	4.27	0.77	Strongly Agree
…construct solutions to challenging mathematical problems.	4.32	0.84	Strongly Agree
Weighted Mean	4.33		
SD	0.77		
Verbal Interpretation	Very High		

Generally, the findings highlight that students display a high level of confidence in mathematics. Their ability to recall formulas, apply learned concepts, and tackle difficult problems demonstrates a positive view of their competence in both performing and learning mathematics.

Level of Students' Self-Efficacy in Terms of Persistence

Table 8 illustrates the level of students' self-efficacy in mathematics in terms of persistence. As a student in mathematics class I understand that effort and practice improve my performance in mathematics acquired the highest mean score (M = 4.38, SD = 0.69), interpreted as Strongly Agree. In contrast, as a student in mathematics class, I create a plan or strategy to complete difficult math problems successfully obtained the lowest mean score (M = 4.27, SD = 0.91), which is also interpreted as Strongly Agree.

Table 8. Level of Students' Self-Efficacy in Terms of Persistence

Statements As a student in mathematics class I…	Mean	SD	Remarks
…remember methods that help me continue working when math problems are difficult.	4.37	0.77	Strongly Agree
…understand that effort and practice improve my performance in mathematics.	4.38	0.69	Strongly Agree
…examine which parts of a problem cause	4.34	0.80	Strongly

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difficulty and keep working on them.			Agree
…assess my progress and decide to continue until I finish the task.	4.31	0.80	Strongly Agree
…create a plan or strategy to complete difficult math problems successfully.	4.27	0.91	Strongly Agree
Weighted Mean	4.33		
SD	0.79		
Verbal Interpretation	Very High		

The weighted mean of 4.33, with a standard deviation of 0.79, indicates a Very High level of students' self-efficacy for persistence in mathematics. This denotes that students remain motivated and continue working even when they encounter challenging problems in mathematics.

Collectively, the findings emphasize that students show perseverance in learning mathematics. Their willingness to keep working on difficult tasks, assess challenging parts of a problem, and track their progress means they believe in their capacity to overcome obstacles and complete mathematical.

Table 9 presents the level of students' self-efficacy in mathematics with respect to self-regulated learning. As a student in mathematics class I regulate my time and effort when completing math activities yielded the highest mean score (M = 4.43, SD = 0.74), interpreted as Strongly Agree.

Moreover, as a student in mathematics class I formulate and adjust plans to improve my learning when I face difficulties got the lowest mean score (M = 4.19, SD = 0.82), interpreted as Agree.

Table 9. Level of Students' Self-Efficacy in Terms of Self-Regulated Learning

Statements As a student in mathematics class I…	Mean	SD	Remarks
…reflect on the learning goals I set for myself.	4.33	0.75	Strongly Agree
…outline a plan before starting a mathematics task.	4.27	0.77	Strongly Agree
…regulate my time and effort when completing math activities.	4.43	0.74	Strongly Agree
…assess the accuracy of my answers and the effectiveness of my strategies.	4.31	0.86	Strongly Agree
…formulate and adjust plans to improve my learning when I face difficulties	4.19	0.82	Agree
Weighted Mean	4.31		
SD	0.79		
Verbal Interpretation	Very High		

The weighted mean of 4.31, with a standard deviation of 0.79, indicates a Very High level of students' self-efficacy in self-regulated learning. This implies that, when it comes to planning tasks, monitoring progress, and evaluating strategies, students believe they can successfully manage their learning.

In conclusion, the findings highlight that students possess strong self-regulation in mathematics. Their confidence in managing their own learning can be observed by their ability to set goals, organize tasks, and monitor their performance. This can support a better understanding and the successful completion of mathematical tasks.

Level of Students' Cognitive Abilities

The level of students' cognitive abilities was examined in terms of memory, information processing, logical reasoning, and representational abilities. The findings are presented in the table below, which shows the statements, their mean scores, standard deviations, remarks, and corresponding verbal interpretations.

Table 10 exhibits the level of students' cognitive abilities for memory ability. The results revealed that most of the participating students have a strong ability to remember. Of the participating students (54.37%) scored in the 9-10 range, which is considered to be an outstanding level of memory ability; 35.92% scored in the 7-8 very satisfactory range; 8.74% scored in the 5-6 range, which is satisfactory, and 0.97% scored in the 3-4 range, which would be considered as fairly satisfactory. Notably, no student obtained scores in the 1–2 range, which corresponds to "did not meet expectations," indicating that all students achieved at least a fairly satisfactory level of memory ability.

Table 10. Level of Students' Cognitive Abilities in Terms of Memory Ability

	Cognitive Abilities Test		
Scores	F	%	Descriptive Equivalent
9-10	56	54.37%	Outstanding
7-8	37	35.92%	Very Satisfactory
5-6	9	8.74%	Satisfactory
3-4	1	0.97%	Fairly Satisfactory
1-2	0	0.00%	Did Not Meet Expectation
Total	103	100%	
Weighted Mean	8.35		
SD	1.41		
Verbal Interpretation	Very Satisfactory		

The weighted mean score of 8.35, with a standard deviation of 1.41, indicates that the students' overall memory ability is very satisfactory. This indicates that, on average, students can recall and maintain previously learned mathematical concepts well. In addition, the low standard deviation reflects that student scores are tightly clustered around the mean. Therefore, there is a consistent level of memory ability among all students.

To sum up, most students show strong memory abilities in mathematics, with many performing at a high level. The absence of low scores indicates effective recall and understanding of mathematical concepts.

Table 11 shows the level of students' cognitive abilities regarding information processing. The results indicate that a large proportion of participating students demonstrate a high level of information-processing ability. Of the 103 respondents, 50.49% obtained scores ranging from 9–10, which are interpreted as Outstanding. Meanwhile, 34.95% of the students scored within the 7–8 range, corresponding to Very Satisfactory performance. In addition, 7.77% of the students obtained scores within the 5–6 range, described as Satisfactory, while 6.80% scored between 3–4, which is interpreted as Fairly Satisfactory. Clearly, no students scored in the 1–2 range, which indicates Did Not Meet Expectation, suggesting that all students showed at least a fairly satisfactory level of information-processing ability.

Table 11. Level of Students' Cognitive Abilities in Terms of Information Processing Ability

	Cognitive Abilities Test		
Scores	F	%	Descriptive Equivalent
9-10	52	50.49%	Outstanding

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7-8	36	34.95%	Very Satisfactory
5-6	8	7.77%	Satisfactory
3-4	7	6.80%	Fairly Satisfactory
1-2	0	0.00%	Did Not Meet Expectation
Total	103	100%	
Weighted Mean		8.12	
SD		1.60	
Verbal Interpretation		Very Satisfactory	

The weighted mean score of 8.12, with a standard deviation of 1.60, indicates that the students' overall information – processing ability is Very Satisfactory. The mean score reveals that students are generally capable of understanding, organizing, and applying mathematical information when solving problems. Meanwhile, the standard deviation indicates moderate variation in scores, indicating that although most students performed well, there are still differences in their information-processing abilities.

In summary, the findings show that most students have strong information-processing ability. Their high proportion of outstanding and very satisfactory scores indicates that they can interpret concepts, analyze information, and apply procedures to solve mathematical tasks.

Level of Students' Cognitive Abilities in Terms of Logical Reasoning Ability

Table 12 presents the level of students' cognitive abilities regarding logical reasoning. The results show that a considerable number of the participating students demonstrate satisfactory to very satisfactory levels of logical reasoning ability. Among the 103 respondents, 37.86% obtained scores within the 7–8 range, which is interpreted as Very Satisfactory. Meanwhile, 31.07% of the students scored in the 9–10 range, which is described as Outstanding. In addition, 20.39% obtained scores in the 5–6 range, corresponding to Satisfactory, while 10.68% scored between 3–4, interpreted as Fairly Satisfactory. Remarkably, every student attained at least a fairly satisfactory level of logical reasoning, as evidenced by the fact that no student scored in the 1-2 range, which corresponds to Did Not Meet Expectation.

Table 12. Level of Students' Cognitive Abilities in Terms of Logical Reasoning Ability

	Cognitive Abilities Test		
Scores	F	%	Descriptive Equivalent
9-10	32	31.07%	Outstanding
7-8	39	37.86%	Very Satisfactory
5-6	21	20.39%	Satisfactory
3-4	11	10.68%	Fairly Satisfactory
1-2	0	0.00%	Did Not Meet Expectation
Total	103	100%	
Weighted Mean		7.25	
SD		1.88	
Verbal Interpretation		Very Satisfactory	

The weighted mean score of 7.25, with a standard deviation of 1.88, indicates that the students' overall logical reasoning ability is Very Satisfactory. The mean score that students generally possess the ability to analyze relationships, evaluate given information, and apply logical thinking when solving mathematical problems. The standard deviation indicates a relatively wide spread of scores, suggesting some variation in students' reasoning abilities.

Generally, the findings reveal that most students demonstrate a good level of logical reasoning in mathematics. They can analyze problems and apply logical steps in solving tasks, although some variation in reasoning ability is still observed.

Table 13 illustrates the level of students' cognitive abilities regarding representational ability. The results show that many of the participating students demonstrate a satisfactory to very satisfactory level of representational ability. Among the 103 respondents, 39.81% obtained scores within the 7–8 range, which is interpreted as Very Satisfactory. Meanwhile, 32.04% of the students scored within the 9–10 range, which is described as Outstanding. In addition, 22.33% obtained scores within the 5–6 range, corresponding to Satisfactory, while 5.83% scored within the 3–4 range, interpreted as Fairly Satisfactory. Of particular note, all students showed at least a fairly satisfactory level of representational ability supported that no students had scores in the 1-2 range, which corresponds to Did Not Meet Expectation.

Table 13. Level of Students' Cognitive Abilities in Terms of Representational Ability

	Cognitive Abilities Test		
Scores	F	%	Descriptive Equivalent
9-10	33	32.04%	Outstanding
7-8	41	39.81%	Very Satisfactory
5-6	23	22.33%	Satisfactory
3-4	6	5.83%	Fairly Satisfactory
1-2	0	0.00%	Did Not Meet Expectation
Total	103	100%	
Weighted Mean		7.52	
SD		1.74	
Verbal Interpretation		Very Satisfactory	

The weighted mean score of 7.52, with a standard deviation of 1.74, indicates that the students' overall representational ability is Very Satisfactory. The mean score indicates that students are generally able to express mathematical ideas in various forms, such as symbols, tables, graphs, or mathematical expressions, when solving problems. Meanwhile, the standard deviation indicates some variation in the students' performance, showing that while many students perform well, their representational abilities differ in level.

Collectively, the findings show that most students have a good level of representational ability in mathematics. They can interpret and present mathematical information in different forms, supporting better understanding and communication of solutions.

Test of Association between the Teaching Methods in Mathematics and Students' Attitudes

In this study, the significant relationship between teaching methods in Mathematics and students' attitudes refers to the statistical association between activity-based, heuristic, and analytic teaching methods and students' attitudes toward openness to learning, enjoyment, and willingness to participate.

Table 14 shows that the relationships between teaching methods in Mathematics and students' attitudes generally fall

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within the moderate-to-high positive correlation range, based on the given interpretation scale. For the activity-based method, the correlations range from low to moderate positive relationships with students' attitudes. Specifically, openness to learning (r = .578), enjoyment (r = .445), and willingness to participate (r = .532) all fall under the moderate correlation category. This indicates that activity-based strategies have a meaningful but not dominant influence on students' attitudes.

Table 14. Significant Relationship between the Teaching Methods in Mathematics and Students' Attitudes

Teaching Methods in Mathematics		Openness to Learning	Enjoyment	Willingness to Participate
Activity-Based Method	Pearson Correlation	.578**	.445**	.532**
	Sig. (2-tailed)	.000	.021	.000
	N	103	103	103
Heuristic Method	Pearson Correlation	.578**	.561**	.614**
	Sig. (2-tailed)	.000	.001	.000
	N	103	103	103
Analytic Method	Pearson Correlation	.562**	.523**	.601**
	Sig. (2-tailed)	.000	.022	.000
	N	103	103	103

For the heuristic method, the correlations are generally stronger. Openness to learning (r = .578) and enjoyment (r = .561) show a moderate correlation, while willingness to participate (r = .614) shows a high correlation. This indicates that heuristic teaching methods are more strongly associated with positive student attitudes, particularly in encouraging participation.

For the analytic method, openness to learning (r = .562) and enjoyment (r = .523) both indicate a moderate correlation, while willingness to participate (r = .601) is at the upper range of moderate correlation, approaching high correlation. This implies that analytic methods also play a significant role in shaping students' attitudes, especially in structured learning engagement.

Overall, all teaching methods show positive, statistically significant relationships with students' attitudes, ranging from moderate to high correlations, with the heuristic method demonstrating the strongest association.

Test of Association between the Teaching Methods in Mathematics and Students' Self-efficacy

In this study, the significant relationship between teaching methods in Mathematics and students' self-efficacy refers to the statistical association between activity-based, heuristic, and analytic teaching methods and students' attitudes toward competence, persistence, and self-regulated learning.

Table 15 presents the significant relationships between teaching methods in Mathematics and students' self-efficacy in competence, persistence
and self-regulated learning.

Table 15. Significant Relationship between the Teaching Methods in Mathematics and Students' Self-efficacy

Teaching Methods in Mathematics		Competence	Persistence	Self-Regulated Learning
Activity-Based Method	Pearson Correlation	.572**	.574**	.391**
	Sig. (2-tailed)	.000	.021	.000
	N	103	103	103
Heuristic Method	Pearson Correlation	.586**	.573**	.376**
	Sig. (2-tailed)	.000	.001	.000
	N	103	103	103
Analytic Method	Pearson Correlation	.610**	.549**	.553**
	Sig. (2-tailed)	.000	.022	.000
	N	103	103	103

For the activity-based method, competence (r = .572) and persistence (r = .574) show moderate positive correlations, whereas self-regulated learning (r = .391) shows a low positive correlation. This indicates that activity-based approaches are effective in enhancing students' confidence and perseverance, but have a comparatively weaker influence on self-regulated learning.

The heuristic method also demonstrates moderate positive correlations with competence (r = .586) and persistence (r = .573), while self-regulated learning (r = .376) shows a low positive correlation. This implies that heuristic strategies support students' ability and persistence, although their impact on independent learning regulation is less pronounced.

For the analytic method, competence (r = .610) shows a high positive correlation, while persistence (r = .549) and self-regulated learning (r = .553) both show moderate positive correlations. This reveals that analytic teaching methods have the strongest association with students' sense of competence and also contribute meaningfully to persistence and self-regulated learning.

Test of the Significant Effect of Teaching Methods in Mathematics on the Students' Cognitive Abilities

The significant effect of teaching methods in mathematics on the students' cognitive abilities in terms of memory ability, information processing ability, logical reasoning ability, and representational ability was treated statistically using Real Statistics Data Analysis Tools using multiple regression analysis.

Table 16 shows the results of a multiple regression analysis conducted to determine whether teaching methods in mathematics, in terms of activity-based method, heuristic method, and analytic method, could significantly predict students' cognitive abilities in terms of memory, information processing, logical reasoning, and representational abilities.

Across all four cognitive domains, the results consistently show that the regression models are not statistically significant, as indicated by their F-values and p-values ($p > 0.05$). This means that the combined use of activity-based,

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heuristic, and analytic teaching methods does not significantly predict students' cognitive abilities in Mathematics. In other words, the way Mathematics is taught, based on these three approaches, does not have a measurable effect on students' memory, information processing, logical reasoning, or representational skills. Furthermore, when examined individually, none of the teaching methods significantly contributed to any cognitive ability, as all corresponding p-values exceeded 0.05. This indicates that activity-based, heuristic, and analytic methods, whether through hands-on activities, guided discovery, or structured instruction, does not independently influence students' cognitive performance in the areas measured.

Table 16. Regression Analysis on the Effect of Teaching Methods in Mathematics on the Students' Cognitive Abilities

Coefficients[a]

Model	Unstandardized Coefficients		T	Sig.
	B	Std. Error		
(Constant)	4.20	0.77	5.46	0.000
Activity-Based Method	0.02	0.24	0.08	0.936
Heuristic Method	0.10	0.22	0.45	0.651
Analytic Method	-0.06	0.22	-0.29	0.770
(Constant)	3.28	0.97	3.39	0.001
Activity-Based Method	-0.09	0.30	-0.29	0.774
Heuristic Method	0.22	0.27	0.82	0.413
Analytic Method	0.09	0.28	0.33	0.743
(Constant)	2.86	1.07	2.68	0.009
Activity-Based Method	-0.02	0.33	-0.06	0.954
Heuristic Method	0.17	0.30	0.57	0.573
Analytic Method	0.08	0.30	0.27	0.787
(Constant)	3.12	0.97	3.21	0.002
Activity-Based Method	-0.18	0.30	-0.61	0.546
Heuristic Method	0.13	0.27	0.48	0.632
Analytic Method	0.25	0.28	0.89	0.374

Overall, the findings indicate that teaching methods alone are not strong predictors of students' cognitive abilities in Mathematics. Therefore, factors other than teaching methods may be more crucial to improving students' mathematical cognitive abilities, such as memory, information processing, logical reasoning, and representational skills.

IV. Conclusion and Recommendations

There is a significant relationship between teaching methods in Mathematics and students' attitudes in terms of openness to learning, enjoyment, and willingness to participate. Therefore, the null hypothesis is rejected. This means that teaching methods have a meaningful influence on students 'attitudes toward Mathematics, with heuristic methods showing the strongest association.

There is a significant relationship between teaching methods in Mathematics and students' self-efficacy in terms of competence, persistence, and self-regulated learning. Hence, the null hypothesis is rejected. This indicates that instructional methods contribute to students' belief in their abilities and their capacity for independent learning, with analytic methods showing relatively stronger effects on competence.

There is no significant effect of teaching methods in Mathematics on students' cognitive abilities in terms of memory, information processing, logical reasoning, and representational skills. Therefore, the null hypothesis is accepted. This implies that activity-based, heuristic, and analytic teaching methods do not significantly predict students' cognitive performance in Mathematics.

The researcher proposed the following recommendations based on the findings, summary, and conclusions drawn.

Teachers may enhance activity-based, heuristic, and analytic methods by integrating higher-order thinking, problem-solving, and metacognitive strategies, using differentiated instruction and scaffolding, and assessing both student engagement and cognitive development through performance-based tasks.

Students may improve their cognitive abilities in Mathematics by engaging in independent problem-solving, self-directed learning, and regular practice, while developing consistent study habits and discipline beyond classroom instruction.

Future researchers may replicate the study with a larger and more diverse sample, consider additional variables, and use mixed-method experimental designs with longer implementation periods to further examine the relationship and effects of teaching methods on students' outcomes.

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