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Understanding the Roles of Teaching Pedagogies and Learning Styles on Students' Achievement in Mathematics

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ABSTRACT

This study determined the relationship between teachers' teaching pedagogies and students' learning styles and the Mathematics academic performance of junior high school students in EDDIS III of Bulacan during the School Year 2023–2024. With explanatory sequential mixed methods as research design and 131 math teachers and 607 students as respondents of the study, findings showed that the teachers themselves described their teaching pedagogies very evident. However, their students described their teaching pedagogies in Math as evident only. Meanwhile, in learning Math, auditory learning style is the most dominant among the junior high school students and the least dominant is tactile learning style. The academic performance of the junior high school students was generally described as "satisfactory". Based on the findings of the study, these conclusions were drawn: The teaching pedagogies of the math teachers was described by them as very evident while their students described it only as evident. The dominant learning styles among the students is auditory. The junior high school students performed satisfactorily in Math. The teaching pedagogies of the teachers had a significant influence to students' academic performance in Math. The learning styles of the students significantly influence their academic performance in Math.

Introduction

Filipino students were among the lowest performing groups of students among all the participating countries in the 2018 Programme for International Student Assessment (PISA). In mathematics, less than 20% of students demonstrated the minimum proficiency level (Level 2), while more than 50% showed very low proficiency (below Level 1). Scoring below the lowest level of proficiency in the PISA, these Filipino students have been clearly left behind in terms of mathematics education; more than half of this age group of Filipino students have inadequate mathematical skill compared to their peers in other parts of the world. The poor performance in mathematics also varied in degree between the students in public and private schools, where the means were 343 and 395, respectively (Department of Education 2019).

Students' mathematics proficiency in the PISA assessment relates to the students' capacity to formulate, use, and interpret mathematics in different contexts, including familiar personal experiences and in broader and more abstract contexts of work, society, and science. Students who are assessed to have good mathematics proficiency are able "to reason mathematically and use mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena" (OECD 2019a). The test items were given in combinations of the different mathematical processes, mathematical content, and contexts. The mathematical processes included formulating situations mathematically, employing mathematical concepts, facts, procedures and reasoning, and interpreting, applying, and evaluating mathematical outcomes. Underlying these mathematical processes were fundamental mathematical capabilities such as understanding a problem situation, its tasks, and questions; being able to present, explain and justify a solution; translating and representing the problem and its quantities into a mathematical form; and utilizing mathematical content knowledge and tools to solve the problem and to communicate results (OECD 2019a).

In a sense, the results are not surprising as the Philippines had been consistently performing poorly in mathematics in the global assessments. It had not been able to improve from the bottom 5 ranks since it joined Trends in Mathematics and Science Study (TIMSS) in 1999. However, the Philippine government chose to participate in PISA 2018 with the aim of gaining knowledge from the international large-scale assessment to help improve the current educational system (National Economic Development Authority 2020). Indeed, the PISA provides data on a wide range of variables that can be studied as possible predictors of successful (or unsuccessful) learning in the different domains. These variables might be interacting in ways that predict either poor or good mathematics achievement.

Research has revealed many important predictors of mathematics learning and achievement, and most of the predictors can be classified under one of five broad categories: student factors, family factors, teacher factors, classroom and school factors, and policy factors (Maamin et al. 2021). In the Philippines, teachers' pedagogy and lower teacher resources are associated with lower student attention, lower student respect, more concerns with attendance, bullying, other problematic student behaviors, and student achievement (Trinidad 2020).

Pedagogy is any activity consciously designed by a teacher to bring about effective learning in the students, with the aim of motivating and making the student's journey successful and productive throughout life in the 21st century (Wlodkowski and Ginsberg, 2017). This therefore underscores the importance of adopting active pedagogies by establishing learner-centered approaches that will encourage learners to be in control of their learning. Hence, one of the ways to achieve this is through the adoption and utilization of innovative facilitation approaches (Yuen, 2016).

Pedagogy or what is commonly referred to as teachers' technical skills is what distinguishes professional teachers from nonprofessionals. In today's educational practice, pedagogical skills appear to be a rare and scarce commodity even among professionally trained teachers. Meanwhile, innovative pedagogy is a learning approach that defines in a new way how knowledge, skills and attitudes are assimilated, produced and used by learners in a manner that equips the learner with relevant knowledge, marketable skills that will earn the learner an income, attitudes and values that demonstrate compassion and caring for self, others and the environment (Nabwire, 2016).

Past studies have identified the increasing effectiveness of new pedagogy practices where classroom instruction is centered on the student. White teachers in the United States must incorporate reflective practices to address personal biases that may impede upon their ability to create a student -centered learning environment with diverse student populations. Cultural awareness of diverse students has become integral in preparing lessons and also designing curriculums requiring educators to understand different cultural practices and histories that can improve the delivery of educational programs (Butler, 2020).

Meanwhile, Magulod Jr. (2019) examined the learning style preferences, study habits and level of academic achievement of students enrolled in applied science courses of one campus of a public higher education institution in the Philippines. Results of the study revealed that the students of applied sciences courses preferred visual, group and kinesthetic as major learning styles while they manifest a moderate level of study habits. They also have a good level of academic achievement. Moreover, significant relationships were found between learning styles, study habits and academic performance of students in applied science courses. The implications of the study can guide instructors to plan and deliver suitable instructional interventions.

Consequently, Dela Cruz and Cardino Jr. (2020) found in their study that most of the student-respondents have a combination of dependent, collaborative and independent learning styles. Multiple regression analysis indicates that among the learning styles, only the independent style has a significant influence on the academic performance of grade 9 students. Four teaching strategies including cooperative learning, deductive approach, inductive approach, and integrative approach, were found to have a significant influence on academic performance. By understanding the learning styles of students, teachers will be guided in designing different strategies to help students enhance learning for their improved performance in mathematics.

On the contrary, the findings of the study conducted by Ocampo et al., (2023) revealed no significant relationship between learning styles and academic performance in mathematics. However, it is worth noting that the lack of a significant relationship does not necessarily mean that there is no relationship at all. Motivation, teacher quality, and cultural background may also influence mathematics performance. The findings suggest that educators should consider students' different learning styles when developing effective teaching strategies to enhance mathematics performance among Grade 8 students. This study contributes to the literature on mathematics education and has practical implications for educators seeking to enhance their students' mathematics performance.

In view of the premise presented above, this study has been conceptualized with the hope that teachers' pedagogy would establish a significant relationship with students' learning outcomes.

From the reviewed related studies, theories and related literature, the researcher came up with a paradigm which served as guide in the conduct of the study and which is exhibited in Figure 1.

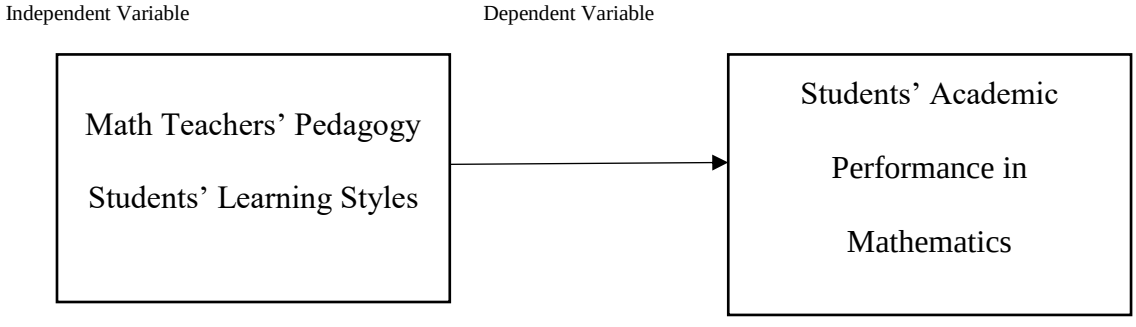


Figure 1. Paradigm of the Study

Statement of the Problem

This study determined the relationship between teachers' teaching pedagogies and students' learning styles and the Mathematics academic performance of junior high school students in Educational District III (EDDIS III) of Bulacan during the School Year 2023 – 2024.

Specifically, it sought answers to the following questions:

1. How may the Math teachers' teaching pedagogies be described in terms of:

1.1 Managing of class;

1.2 arranging for learning;

1.3 building on students' thinking;

1.4 worthwhile mathematical tasks;

1.5 making connections;

1.6 assessment for learning;

1.7 mathematical communication;

1.8 mathematical language;

1.9 tools and representations; and

1.10 teacher knowledge?

2. How may the students' learning styles be described in terms of:

   2.1 visual learning;

   2.2 auditory learning; and

   2.3 tactile learning?

3. How may the junior high school students' academic performance be described in terms of their grades in Mathematics in the first grading period?

4. Is there a significant relationship between the teachers' pedagogy and their students' academic performance in Mathematics?

5. Is there a significant relationship between the students' learning styles and their academic performance in Mathematics?

6. What are the views and insights of the respondents as regards the importance of pedagogy and learning styles on students' academic performance in Math?

7. What program of activities can be crafted from the results of the study?

Hypotheses

The following hypotheses were tested in the study:

1. There is no significant relationship between the teachers' pedagogy and their students' academic performance in Mathematics.

2. There is no significant relationship between the students' learning styles and their academic performance in Mathematics.

II. RESEARCH METHODS

The information about the research and sampling procedures that will be utilized by the researcher are provided in this chapter. The research design that will be employed, as well as the data gathering techniques, and data analysis scheme are also discussed in this chapter.

Research Design

This study was conducted to determine if significant correlation existed between the teachers' pedagogies and their students' academic performance in Mathematics. Moreover, the relationship between students' learning styles and their performance in Mathematics was obtained. Further, it looked into the views and insights of the students with regard to the importance of pedagogies on their academic performance. In order to attain these objectives, the researcher utilized the explanatory sequential design. In an explanatory sequential design, quantitative data collection and analysis occurred first, followed by qualitative data collection and analysis. In the conduct of the present study, the assessments of the junior high school teachers with regard to their pedagogies in teaching math was solicited through the use of closed-ended questionnaire. Moreover, the grades of their students were obtained. After gathering these data, statistical analysis was followed. From the quantitative results of the study, the open-ended questions were formulated. These questions were asked to selected teachers during the semi-structured interview which is the main source of the qualitative data. Results of the interview were used to validate the quantitative results of the study. Additionally, this was utilized to further explain and to arrive at a more in-depth discussions of the quantitative findings of this research.

Sampling and Respondents

For the teacher respondents, total enumeration was used in the conduct of this study. All the Math teachers in junior high schools in EDDIS III or 131 teachers were requested to participate in the study.

For the student respondents, since the population is too large, the researcher applied purposive sampling which is a non-probability sampling technique in which samples are selected because they have characteristics that are needed in the study. Further, only ten percent were selected at random to represent the student respondents. According to Gay & Diehl, (1992), generally the number of respondents acceptable for a study depends upon the type of research involved - descriptive, correlational or experimental. For descriptive research the sample should be 10% of the population for a larger population as large as 1000. But if the population is small (as small as 500 and below) then 20% may be required.

It can be noted from Table 1 that out of 6066 total population of students, only 607 were selected at random and were requested to participate in quantitative data collection.

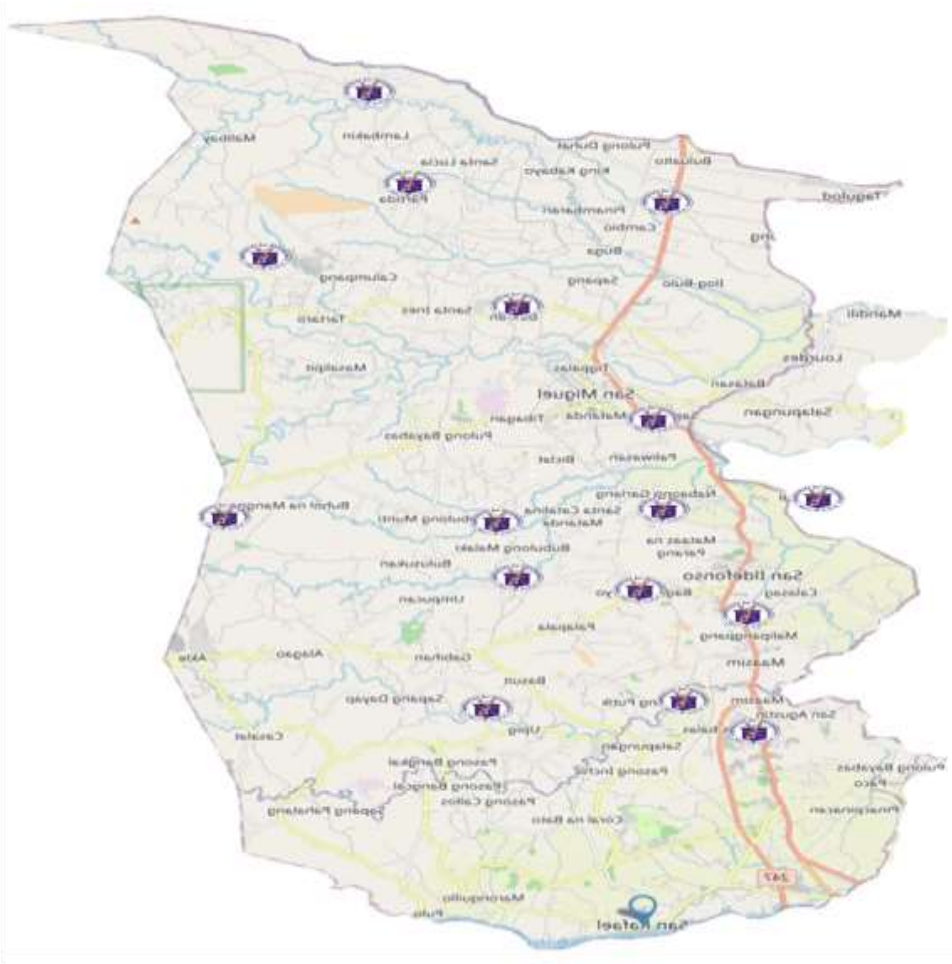
Table 1. Distribution of Respondents of the Study

School	Math Teachers	Students (N)	Students (n)
1. San Ildefonso National High School	14	763	76
2. Calawitan National High School	4	143	14
3. Sta. Catalina Bata National High School	2	85	9
4. Akle High School	4	137	14
5. Gabihan High School	1	42	4
6. Upig High School	3	86	9
7. San Miguel National High School	35	1326	133
8. Emilia Perez Ligon High School	2	72	7
9. Partida National High School	6	423	42
10. John J. Russell Memorial High School	9	512	51
11. Vedasto R. Santiago High School	12	652	65
12. San Rafael National Trade School	7	390	39
13. Maronquillo National High School	4	162	16
14. Carlos F. Gonzales High School	19	921	92
15. Salapungan National High School	5	163	16
16. Lydia D. Villangca Trade School	4	189	19
Total	131	6066	607

For the qualitative part, five (5) male and five (5) female teachers and students (from the big schools) were selected at random to participate in the interview. Fishbowl draw or lottery method was used to select the teachers and students who participated in the interview. In this method, all names of the teachers and students were written down each number on a slip of paper and fold them so that the number is not visible. Male was separated from female. Then, the researcher selected 5 numbers of slips randomly from each group. The selected teachers were subjected from the semi-structured interview to solicit their views and insights as regards the importance of pedagogies to students' academic performance. On the other hand, students were asked about the significance of their teachers' pedagogy ang their own learning styles on their academic performance in Mathematics.

Locale of the Study

This study was conducted in the secondary schools in San Rafael, San Ildefonso and San Miguel Bulacan. The schools that will be included as respondents of this research are presented in Table 1.



https://www.google.com/search?q=6th+district+of+bulacan

Figure 2. Map of 3rd District of Bulacan

Instruments

Two types of data will be gathered in order to answer the problems of the study, the quantitative and qualitative data. For the quantitative data collection, questionnaire about Math Pedagogies which was adapted from Anthony and Walshaw (2009), was administered to teacher respondents. Meanwhile, the questionnaire used to describe the students' learning styles was adapted from DePorter and Mike (2016). The grades of the students in Mathematics were obtained from the Math teacher respondents. For the collection of qualitative data, open-ended questionnaire was utilized.

Data Gathering Procedure

Before sending a request letter to the Schools Superintendent of Bulacan, the researcher accomplished first all the documents required by the DepEd-Bulacan and by the Institute of Education-BASC. After completing these documents, permission from the superintendent of Bulacan was secured. Upon receiving the approved permit, the researcher coordinated with the principals of the school respondents for the schedule of quantitative and qualitative data collection. The researcher personally administered the questionnaire and conducted the semi-structured interview.

In the administration of questionnaires, respondents were given ample time to answer the said questionnaire. Additionally, in the conduct of interview, they were given the rights of not answering the questions if they feel uncomfortable giving their insights as regards the topic.

Data Analysis

After collecting the needed data, these were consolidated and analyzed using some statistical tools. To describe the Math teachers' pedagogies and students' learning styles, weighted mean was computed. To describe the students' performance in Mathematics, mean and standard deviation were computed. To determine if significant correlations existed between teachers' pedagogies and students' performance in Mathematics, Pearson product-moment correlation coefficient analysis was done. The same tool was applied to describe the relationship between students' learning styles and their academic performance in Math. To interpret the qualitative data collected from the interview, thematic analysis was utilized.

Ethical Considerations

The study strictly followed ethical provisions of the College and by the DepEd-Bulacan. The respondents of this research were asked to sign an Informed Consent Form which stipulated that their participation is voluntary and that they were given the freedom to withdraw from their participation at any time they wanted and without any legal obligation. Also, the researcher protected the dignity and anonymity of the participants and the schools that they represented. Further, the participants were also assured of the confidentiality of their responses. Additionally, all information that were obtained, were stored electronically, and at no time would participants be identifiable, as no identifiable information were collected. Respondents were also be given the option to complete the survey at their own leisure or choice of locality. These respondents were also given the assurance that all data gathered from them were used solely for the completion of this study. After passing the final defense which may happen in April 2024 all data stored in the researcher's laptop will be permanently deleted while hard copy of the questionnaire will be destroyed though shredding.

RESULTS AND DISCUSSIONS

The Math Teachers' Teaching Pedagogies

Teacher pedagogical competence is the ability of the teacher in managing learning which includes learning program planning, learning process management and assessment.

Teacher pedagogical knowledge encompasses all the cognitive knowledge necessary to create an effective learning and teaching environment. The effect of enhancing teacher pedagogical skills is generated gradually toward students, whereas when teachers improve pedagogical skills, student achievement will also increase. Pedagogical competence should absolutely be owned by each teacher in order to carry out the learning tasks so that they can do all the things well.

The assessments of the Mathematics teachers and their respective students with regard to teaching pedagogies in terms of managing class, arranging for learning, building on students' thinking, worthwhile mathematical tasks, making connections, assessment for learning, mathematical communication, mathematical language, tools and representations and teacher knowledge are presented in Tables 2 to 11.

Managing of Class

Class management in the context of mathematics education involves creating an environment that is conducive to learning. Effective management strategies include establishing clear expectations, maintaining a positive and inclusive classroom culture, addressing behavioral challenges, and promoting student engagement. Skillful class management sets the stage for a productive and focused learning experience.

Table 2. The Math Teachers' Teaching Pedagogies in terms of Managing of Class

Item Statement	Teachers			Students		
The Math teacher…	Mean	VD	SD	Mean	VD	SD
1. works hard at developing trusting classroom communities.	4.18	E	1.08	3.98	E	1.10
2. ensures that their classrooms have a strong mathematical focus.	4.12	E	1.18	3.58	E	1.12
3. cares about the development of students' mathematical proficiency.	4.58	VE	0.98	4.35	VE	0.88
4. creates such an environment by respecting and valuing the mathematics and the cultures that students bring to the classroom.	4.20	E	1.06	4.26	VE	0.96
5. cares about the development of students' mathematical identities.	4.36	VE	0.99	4.22	VE	0.98
6. allows students to develop a positive attitude to mathematics.	4.42	VE	1.01	4.30	VE	1.01
Overall Mean	4.31	VE	1.05	4.12	E	1.01

Legend: 4.21 – 5.00 Very Evident (VE)

3.41 – 4.20 Evident (E)

2.61 – 3.40 Moderately Evident (ME)

1.81 – 2.60 Slightly Evident (SE)

1.00 – 1.80 Not Evident (NE)

In Table 2, the statement "The Math teacher ensures that their classrooms have a strong mathematical focus" received a mean score of 4.12, falling within the "Evident (E)" range. This suggests that, on average, both teachers and students perceive a strong mathematical focus in the Math teacher's classrooms.

The implication of this relatively high mean is that the Math teacher is successful in creating an environment that emphasizes and fosters mathematical learning. This positive perception is crucial for effective teaching and student engagement in mathematical concepts.

On the other hand, the statement "The Math teacher cares about the development of students' mathematical proficiency" obtained a high mean score of 4.58, placing it in the "Very Evident (VE)" range. This indicates a widespread agreement among teachers and students that there is a strong commitment to nurturing students' mathematical proficiency. The implication of this high mean is significant, suggesting that the teacher is not only focused on imparting knowledge but also genuinely invested in the overall development of students' mathematical skills. This dedication is likely to contribute positively to students' academic growth and success in mathematics.

During the interview, the teachers shared that they prioritize a trusting classroom community by consistently working hard to develop connections with students. They emphasized the importance of respecting and valuing both the mathematical content and the diverse cultures students bring to the classroom. According to the majority of participants, teachers, on average, scored high in creating a positive and inclusive environment. From the student's perspective, the majority reported that their math teacher succeeds in creating an environment that fosters trust and positive attitudes towards mathematics. The students feel that the teacher cares about their mathematical development and respects their individual perspectives, contributing to a supportive learning atmosphere.

In the study of Wang and Calvano (2022) it is found that student involvement and teacher interaction play a critical role in student success and satisfaction regardless of class sizes. It also suggested that classroom management involves managing both the content that students are learning and how that content is being delivered.

Arranging for Learning

The organization of classroom activities, resources, and physical space to enhance mathematical learning falls under the umbrella of arranging for learning. This includes thoughtful lesson planning, creating conducive learning environments, and strategically arranging materials to optimize students' understanding and application of mathematical concepts.

Table 3. The Math Teachers' Teaching Pedagogies in terms of Arranging for Learning

Item Statement *The Math teacher…*	Teachers			Students		
	Mean	VD	SD	Mean	VD	SD
1. provides independent thinking time.	4.26	VE	0.99	3.86	E	1.12
2. ensures that all students are given opportunities to think and work quietly by themselves.	4.28	VE	1.04	4.08	E	1.08
3. manages, facilitates and monitors student participation.	4.32	VE	0.99	4.22	VE	0.97
4. records students' solutions, emphasizing efficient ways of doing this.	3.89	E	1.12	3.26	ME	1.10
5. invites students to explain their solutions to others.	4.37	VE	0.98	4.78	VE	0.84
6. allows working with partners and in small groups that can help students to see themselves as mathematical learners.	4.88	VE	0.89	4.33	VE	0.99
Overall Mean	4.33	VE	1.00	4.09	E	1.02

Legend: 4.21 – 5.00 Very Evident (VE)

3.41 – 4.20 Evident (E)

2.61 – 3.40 Moderately Evident (ME)

1.81 – 2.60 Slightly Evident (SE)

1.00 – 1.80 Not Evident (NE)

In Table 3, the statement "The Math teacher allows working with partners and in small groups that can help students to see themselves as mathematical learners" received the highest mean for teachers, scoring 4.88 and falling within the "Very Evident (VE)" range. This indicates a strong consensus among teachers that encouraging collaborative work and group activities contributes significantly to students' perception of themselves as mathematical learners. The implication was that this teaching strategy was highly effective in fostering a positive identity and confidence among students in the realm of mathematics.

For students, the highest mean was obtained for the statement "The Math teacher invites students to explain their solutions to others." Although the specific mean value is not provided, the mention of it being the highest implies that there is a strong positive perception among students regarding the

teacher's practice of inviting explanations. This suggests that students appreciate and benefit from the opportunity to articulate and share their mathematical reasoning, which can enhance their understanding and communication skills in the subject.

On the other hand, the lowest mean for both teachers and students was associated with the statement "The Math teacher records students' solutions, emphasizing efficient ways of doing this." The mean scores for teachers and students were 3.89 (Evident) range and 3.26 (Moderately Evident) range, respectively. The implication of this lower mean is that there may be room for improvement in how the teacher records and emphasizes efficient problem-solving strategies. It suggests that both teachers and students perceive a need for more emphasis on efficiency in capturing and conveying solutions.

The teacher, responding to the interview question, mentioned a deliberate effort to provide independent thinking time and opportunities for collaborative work. The teacher explained how they manage, facilitate, and monitor student participation to ensure a balance. The majority of participants noted that, on average, teachers scored high in fostering both independent and collaborative learning experiences. From the students' perspective, the majority indicated satisfaction with the balance between independent thinking time and collaborative problem-solving in the math classroom. Students appreciated the varied approaches the teacher employed to engage them in both individual and group activities.

In a recent study by Parsons and Parsons (2024) it suggests that students learn more when taking part in classrooms that employed active-learning strategies. Their research findings reveal that active-learning not only enhances students' comprehension and retention of course material but also fosters greater engagement and critical thinking skills, ultimately leading to improved academic performance and long-term knowledge retention. Additionally, the study highlights the importance of instructors integrating technology and collaborative activities to create a dynamic and interactive learning environment that caters to diverse learning styles and preferences.

The Junior High School Students' Academic Performance

The academic performance of the junior high school students in Mathematics is presented in

Table 15. Distribution of the Junior High School Student Respondents According to Academic Outcomes

Grade	f (N=607)	Percent	Verbal Description
90 and above	123	20.26	Outstanding (O)
85 – 89	94	15.49	Very Satisfactory (VS)
80 – 84	179	29.49	Satisfactory (S)
75 – 79	211	34.76	Fairly Satisfactory (FS)
74 and below	0	0.00	Did Not Meet Expectations (DNE)
Mean	82.98		
Verbal Description	Satisfactory (S)		
Standard Deviation	6.31		

It can be noted from the table that more than one-third of 34.76 percent of the junior high school students obtained grades that lie within the bracket of 75 to 79 with a verbal description of "fairly satisfactory." Meanwhile, only more than one-fifth or 20.26 percent received grades that lie within the highest bracket of 90 and above with a verbal interpretation of "outstanding." A closer look at the table reveals that the mean grade of the students was computed at 82.98 which is verbally described as "satisfactory." The standard deviation which measures the spread or variability of the students' grades from the mean was registered at 6.31.

These results show that the grades of the students in Mathematics was considered heterogenous in nature. Further, this indicates that 413 students registered grades that lie within the bracket of 76.67 to 89.29. Results also imply that as reflected in the table, junior high school students experienced difficulties in understanding Math lessons.

In accordance to the findings of the present study, Ginoo (2023) also found in her study that majority of the students obtained a "fairly satisfactory" grades. Further, she stated that many students consider math to be complexities. To be more exciting and convenient, teachers may practice several methods. Localized and contextualized problems may be given to simplify complex tasks. Remedial classes may also be conducted to mitigate the gap in conceptual knowledge.

The Relationship between the Teachers' Pedagogy and their Students' Academic Performance in Mathematics

Table 16 exhibits the results of the correlation analysis which was done to determine if significant relationship existed between teachers' pedagogy in terms of managing of class, arranging for learning, building on students' thinking, worthwhile mathematical tasks, making connections,

assessment for learning, mathematical communication, mathematical language, tools and representations, teacher knowledge, and their students' academic performance in mathematics.

Table 16. Results of Correlation Analysis on the Relationship between Teachers' Pedagogy and their Students' Academic Performance in Mathematics

Teachers' Pedagogy	Students' Academic Performance in Mathematics	
	r-value	p-value
managing of class	0.589**	0.000
arranging for learning	0.657**	0.000
building on students' thinking	0.588**	0.000
worthwhile mathematical tasks	0.874**	0.000
making connections	0.387**	0.007
assessment for learning	0.877**	0.000
mathematical communication	0.401**	0.005
mathematical language	0.638**	0.000
tools and representations	0.799**	0.000
teacher knowledge	0.801**	0.000

Legend: ** = highly significant ($p \leq 0.01$)

Interestingly, highly significant relationship was found between teachers' pedagogy in terms of managing of class, arranging for learning, building on students' thinking, worthwhile mathematical tasks, making connections, assessment for learning, mathematical communication, mathematical language, tools and representations, teacher knowledge, and their students' academic performance in mathematics. This highly significant relationship was brought about by the fact that the computed probability values of 0.007 to 0.000 for these variables are less than the 0.01 level of significance. Further perusal of the tabulated results reveals that direct or positive relationship (as implied by the positive sign of the correlation values that ranged from 0.387 and 0.674) existed between the aforementioned variables. This discloses that as the level of teachers' pedagogy increases, the level of students' academic performance in mathematics also increases.

These results signify that teachers' pedagogy plays a crucial role in determining the learning outcomes of students. Moreover, a well-designed pedagogical approach can foster critical thinking, problem-solving skills, and creativity among students which certainly lead to higher academic performance.

In conformity with the present findings, Osborne (2021) also found in her research that teachers' instructional pedagogies showed statistically significant effects on student mathematics achievement, even after controlling for socioeconomic status (SES) and sex at the student level and school mean SES and whether the school is public or private at the school level. Furthermore, she found that the relationship between teacher instructional pedagogies and student mathematics achievement varied statistically significantly across schools.

Correspondingly, Silva (2023) found that students' math performance is a result of the characteristics of math teachers, including their methods, attitudes, expertise, training, and proper utilization of teaching resources. They are also influenced by their parents, classmates and peers. From the results of the study, he concluded that activities for teaching and learning should guide students towards to the desired learning outcome. This is dependent on the teaching pedagogy the teacher employs. To avoid boredom and to increase engagement, the teacher should make the subject enjoyable so that the students will be focused and engaged. Beginning lessons from the known to the unknown will help students quickly understand the subject matter.

In the conducted interview with the junior high school students, they were asked about the importance of teachers' pedagogy on their performance in Mathematics. Majority of the respondents replied that their teachers have the power to motivate them well before the start of the classes, they will be more interested and more engaged in understanding the lessons. Further, they stated that if they see their teacher as one who is expert and knowledgeable in Math, they will be more inspired and they will feel the challenge to learn the subject matter presented in the class.

The Relationship between the Students' Learning Styles and their Academic Performance in Mathematics

Table 17 displays the results of the correlation analysis which was performed to determine if significant relationship existed between students' learning styles and their academic performance in mathematics.

Table 17. Results of Correlation Analysis on the Relationship between Students' Learning Styles and their Academic Performance in Mathematics

Students' Learning Styles	Students' Academic Performance in Mathematics	
	r-value	p-value
visual learning	0.588**	0.000
auditory learning	0.674**	0.000
tactile learning	0.409**	0.003

Legend: ** = highly significant ($p \leq 0.01$)

It can be observed from the table that highly significant relationship was found between students' learning styles in terms of visual learning (p=0.000), auditory learning (p=0.000), and tactile learning (p=0.003) and their academic performance in mathematics. This highly significant relationship was manifested by the computed probability values that ranged from 0.003 to 0.000 which are less than the 0.01 level of significance. Further observation of the same table shows that direct relationship (as indicated by the positive sign of the correlation values of 0.409 and 0.674) existed between the aforementioned variables. This means that as the level of students' students' learning styles increases, the level of their academic performance in Mathematics also increases.

These results imply that when the junior high school students are fully aware of the appropriate learning styles that can be used in the subject of Mathematics, they can easily understand mathematical concepts more effectively. When students understand the concepts and content of mathematics effectively, they can complete the tasks given by the

teacher excellently without delaying them which eventually resulted to higher academic performance in the subject.

In conformity with the findings of the present study, Mundia and Metussin (2019) reiterated that most students only memorize formulas and steps to solve mathematical problems without understanding them. This causes students to experience difficulties in solving questions or other mathematical problem-solving exercises even if they involve the same question form. Students also think that mathematics assignments are too complicated and difficult because mathematics learning is more abstract (Hui and Rosli, 2021). Therefore, practicing the right learning style can create a positive atmosphere when learning mathematics and subsequently reduce the tendency of students to practice academic procrastination in the subject of Mathematics. Moreover, academic procrastination in the subject of Mathematics also occurs due to a lack of self-confidence and possible fear of the subject (Agustin and Winarso, 2021).

In the same manner, the study of Wan and Mohd (2023) revealed that the auditory learning style was the most dominant learning style among students in the subject of Mathematics, followed by visual and kinesthetic. The level of students' academic procrastination in Mathematics was low. Besides, multiple regression showed that visual and kinesthetic learning styles were significant contributors or predictors, which amounted to 14.1% of the variation in students' academic procrastination in Mathematics.

In the conducted interview with the junior high school students, they were asked about the importance of their learning style in their academic performance in Math. Most of the respondents replied that they strongly believed that if they knew their learning styles, they would be able to utilize it properly in order to learn Math lessons. Further, they added that awareness of learning styles would make them more flexible in treating each lesson to make Math more enjoyable while learning.

Program of Activities Created from the Results of the Study

Results of the study revealed that the assessments of the junior high school students with regard to teaching pedagogy are consistently lower than the assessments of their respective Math teachers. This mean that the teachers are already contented of their pedagogies. However, the students believed that some improvements must be done. Thus, the researcher offers the Program of Activities which is

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Findings

This study determined the relationship between teachers' teaching pedagogies and students' learning styles and the Mathematics academic performance of junior high school students in Educational District III (EDDIS III) of Bulacan during the School Year 2023 – 2024.

Using the procedures described in the preceding chapter, the answers to the problems raised in this study were ascertained and summarized as follows: Findings revealed that the teachers themselves described their teaching pedagogies very evident. However, their students described their teaching pedagogies in Math as evident only.

Meanwhile, in learning Math, auditory learning style is the most dominant among the junior high school students and the least dominant is tactile learning style.

The academic performance of the junior high school students was generally described as "satisfactory".

Highly significant relationship was found between teachers' pedagogy in terms of managing of class, arranging for learning, building on students' thinking, worthwhile mathematical tasks, making connections, assessment for learning, mathematical communication, mathematical language, tools and representations, teacher knowledge, and their students' academic performance in mathematics.

Likewise, highly significant relationship was found between students' learning styles in terms of visual learning, auditory learning, and tactile learning and their academic performance in mathematics.

Conclusions

Based on the findings of the study, the following conclusion was drawn: The teaching pedagogies of the math teachers was described by them as very evident while their students described it only as evident.

The dominant learning styles among the students is auditory.

The junior high school students performed satisfactorily in Math.

The teaching pedagogies of the teachers had a significant influence to students' academic performance in Math.

The learning styles of the students significantly influence their academic performance in Math.

Recommendations

In light of the findings and conclusions of the study, the following recommendations are hereby offered:

1. Teachers may further improve their teaching pedagogies to positively develop the students' academic performance in Math.
2. The school may utilize the program of activities offered by the researcher.
3. For future researchers, further research along this line could be conducted. The same study may be conducted to senior high school students to further understand and validate the results of the present study.

LITERATURE CITED

Anyamene, A. and Odalonu, PI. (2022). Relationship between Learning Styles and Mathematics Academic Achievement of Secondary School Students in Awka Education Zone. *International Journal of Research and Innovation in Social Science (IJRISS)* |Volume VI, Issue II, pp. 614-619.

Abraham, J. (2023). Research in Teacher Education: Trends, Status, and Prospects. In *In: Ahmad, J., Masih, A. (eds) Teaching and Teacher Education in India. Springer, Singapore. https://doi.org/10.1007/978-981-99-4985-4_8* (pp. 159–170). https://doi.org/10.1007/978-981-99-4985-4_8

Agustin, A., and Winarso, W. (2021). Profile of student academic procrastination behavior in problem solving and mathematical digital literacy. *J. Didaktik Matematika* 8, 190–207. doi: 10.24815/jdm.v8i2.21367

Bearneza, FJD. (2023). Students' Learning Styles and Performance in Mathematics: Basis for the Development of Teaching Materials. *International Journal of Innovative Science and Research Technology*, 11(3), 987-998.

Bell, J. D., & Macuga, K. L. (2022). Are tools truly incorporated as an extension of the body representation?: Assessing the evidence for tool embodiment. *Psychonomic Bulletin & Review*, *29*(2), 343–368. https://doi.org/10.3758/s13423-021-02032-6

Cahapay, MB. and Labrador, MGP. (2022). Instructional practices of Filipino teachers in remote mathematics education in COVID-19 times. *International Journal of Didactical Studies*, Volume 3, Issue 1, https://doi.org/10.33902/IJODS.202211753

Campillaa, J. and Castañaga, VA. (2021). Teaching Pedgogies Utilized by Mathematics Teachers in the 21st-Century. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, Volume 59, No 2, pp 140-160.

Cardino Jr., JM and Ortega-Dela Cruz, RA (2020). Understanding of learning styles and teaching strategies towards improving the teaching and learning of mathematics. International Journal on Math, Science and Technology Education, 8(1), 19-43.

Cook, G. (2018). *Why we are wired to connect*. Scientific American. https://www.scientificamerican.com/article/why-we-are-wired-to-connect/

Erath, K., Ingram, J., Moschkovich, J., & Prediger, S. (2021). Designing and enacting instruction that enhances language for mathematics learning: a review of the state of development and research. *ZDM – Mathematics Education*, *53*(2), 245–262. https://doi.org/10.1007/s11858-020-01213-2

Exconde1, TG. and Escabel, EB. (2021). Assessment of Pedagogical Content Knowledge of Math Teachers: Basis for Professional Development Program. *International Journal of Research in Engineering, Science and Management*, Volume 4, Issue 7, pp. 414-420

Feeling connected makes us kind. (n.d.). Greater Good. https://greatergood.berkeley.edu/article/item/feeling_connected_makes_us_kind

Ginoo, SJA. (2023). Math Anxiety, Resiliency, and Math Performance of the Grade 7 Students During the Limited Face-to-face Class. *Educ Res*, 1(1): 30-39.

Granberg, C., Palm, T., & Palmberg, B. (2021). A case study of a formative assessment practice and the effects on students' self-regulated learning. *Studies in Educational Evaluation*, *68*, 100955. https://doi.org/10.1016/j.stueduc.2020.100955

Hui, E., and Rosli, R. (2021). Kebimbangan dan Efikasi Kendiri Terhadap Pembelajaran Matematik dalam kalangan Pelajar Tingkatan Empat. Malays. *J. Soc. Sci. Hum.* 6, 41–53. doi: 10.47405/mjssh.v6i3.690

Iyamuremye, E., Ndayambaje, I., & Muwonge, C. M. (2021). Influence of Teaching Approaches on Students' Performance in Mathematics: A meta-analysis of Quasi-Experimental Studies in Africa. *African Journal of Educational Studies in Mathematics and Sciences.* Vol. 17, No. 2, pp. 73-94.

Jackson, K. L., Tucker, C. S., & Kremer, G. E. O. (2020). Student Perceptions of Tactile and Virtual Learning Approaches: What Can We Learn from their Viewpoint? *Conference Proceedings: 120th ASEE Annual Conference and Exposition*. https://doi.org/10.18260/1-2--22490

Magbanua, CC and Bearneza, FJD. (2023). Learning Style and Performance in Mathematics of Senior High School Students Using Online Blended Learning Modality. *Technium Social Sciences Journal*, Vol. 44, pp. 196-205.

Mason, J. (2020). Generating worthwhile mathematical tasks in order to sustain and develop mathematical thinking. *Sustainability*, *12*(14), 5727. https://doi.org/10.3390/su12145727

Mundia, L., and Metussin, H. (2019). Exploring factors that improve mathematics achievement in Brunei. *Stud. Educ. Eval.* 60, 214–222. doi: 0.1016/j.stueduc.2018.10.003

New theories in Classroom Management in the age of Distance Learning -- THE Journal. (2021, March 9). THE Journal. https://thejournal.com/articles/2021/03/09/new-theories-in-classroom-management-in-the-age-of-distance-learning.aspx

Osborne, M. C. (2021). Teacher instructional practices and student mathematics achievement. *Journal of Educational Research and Practice*, 11(1), 345–358. https://doi.org/10.5590/JERAP.2021.11.1.25

Parsons, L., & Parsons, L. (2024, January 10). *Lessons in learning*. Harvard Gazette. https://news.harvard.edu/gazette/story/2019/09/study-shows-that-students-learn-more-when-taking-part-in-classrooms-that-employ-active-learning-strategies/

Planas, N., & Pimm, D. (2023). Mathematics education research on language and on communication including some distinctions: Where are we now? *Zdm – Mathematics Education*. https://doi.org/10.1007/s11858-023-01497-0

Radzuan, AAM. (2023). The Effect of Mathematics Teacher's Teaching Method on Form Two Students' Mathematics Achievement. *Jurnal Intelek*, Vol. 18, Issue 2, pp. 232-243.

Raiyn, J. (2019). The role of Visual Learning in improving Students' High-Order Thinking skills. *Journal of Education and Practice*, *7*(24), 115–121. http://files.eric.ed.gov/fulltext/EJ1112894.pdf

Razzaghipour, A., Ashrafi, M., & Mohammadzadeh, A. (2024). A Review of Auditory Attention: Neural Mechanisms, Theories, and Affective Disorders. *Indian J Otolaryngol Head Neck Surg*. https://doi.org/10.1007/s12070-023-04373-1

Refugio, C.N., Galleto, P.G., Noblefranca, C.D., Inoferio, H.V., Macias, A.O., Colina, D.G., & Dimalig, C.Y., (2020). Content knowledge level of elementary mathematics teachers: The case of a school district in the Philippines. *Cypriot Journal of Educational Sciences*, 15(3), 619-633. DOI: 10.18844/cjes.v15i3.4551

Silva, NA. (2023). The Effect Of Teacher's Instructional Methods On The Learners Academic Performance In Mathematics Subject In Secondary Schools, A Case Study. *International Journal of Academic Management Science Research (IJAMSR)*, Vol. 7 Issue 2, Pages: 100-107.

Van Zoest, L. R., Peterson, B. E., Leatham, K. R., & Stockero, S. L. (2018). Conceptualizing the teaching practice of building on student mathematical thinking. *International Group for the Psychology of Mathematics Education*. https://files.eric.ed.gov/fulltext/ED583803.pdf

Wan Hussin WAS and Mohd Matore MEE (2023). The influence of learning styles on academic procrastination among students in mathematics. *Front. Psychol*. 14:1239933. doi: 10.3389/fpsyg.2023.1239933

Wang, L., & Calvano, L. (2022). Class size, student behaviors and educational outcomes. *Organization Management Journal*, *19*(4), 126–142. https://doi.org/10.1108/omj-01-2021-1139

Zhang, S. (2023). The Influence of Teachers' Teaching Pedagogies and Attitude on Students' Math Performance. *ASSEHR* 6(4), pp. 202–208, 2023. https://doi.org/10.2991/978-2-494069-13-8_27