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Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

The Math Matrix: Mapping Learning Styles to Academic Performance

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Received: 16 May 2025 **Revised**: 27 June 2025 **Accepted**: 05 July 2025

Available Online: 08 July 2025

Volume IV (2025), Issue 3, P-ISSN – 2984-7567; E-ISSN - 2945-3577

https://doi.org/10.63498/etcor406

Abstract
Aim: This study explored the relationship between students' learning styles and their mathematical performance. By examining these connections, the research aimed to provide insights that would assist teachers in creating more effective, tailored instructional plans to improve mathematics learning outcomes at Capiz State University for the 2023-2024 school year.
Methodology: This study employed the survey-correlation method of research. It involved three hundred sixty (360) students from the Roxas City and Pontevedra campuses. Data were collected using the standardized Grasha-Riechman inventory for learning styles. The statistical methods utilized in the study included mean, standard deviation, and Gamma. The alpha level of significance was established at 0.05.
Results: The findings indicated that the preferred learning style among students is participative. Overall, students demonstrated good academic performance in mathematics. Additionally, there is a significant relationship between learning styles and academic performance, particularly among the dependent style, collaborative style, and participative style.
Conclusion: A comprehensive understanding of students' learning styles can significantly impact the academic success of the teaching and learning process.
Keywords: *learning styles, academic Performance, mathematics*

INTRODUCTION

Teaching mathematics remains one of the most persistent challenges in education worldwide. Even the most skilled instructors face difficulties in communicating complex mathematical concepts in ways that engage students with diverse backgrounds and abilities. Mathematics learning is often shaped by students' attitudes, motivation, prior knowledge, and, importantly, their individual learning styles. While traditional instruction tends to be one-size-fits-all, growing evidence suggests that understanding and adapting to students' preferred learning styles can improve both engagement and achievement (Abenojar, et al., 2025; Dizon & Sanchez, 2020; Muńoz & Sanchez, 2023; Pangilinan, 2025; Taş & Minaz, 2024). Yet, despite this potential, many tertiary-level mathematics courses continue to be taught with limited differentiation, overlooking learners' diverse needs.

Learning styles, broadly defined as consistent ways in which individuals prefer to receive and process information, have been the subject of considerable debate and research. Models such as the Grasha-Riechmann typology have classified students as independent, dependent, collaborative, participative, competitive, and avoidant learners, recognizing that these preferences shape how students approach learning tasks and respond to instruction. Prior studies have shown that aligning teaching strategies with students' learning styles can improve outcomes in various subjects. However, most research has focused on primary and secondary education or on subjects such as language or social studies. Mathematics at the university level, particularly in the Philippine context, remains underexplored.

This gap is critical because mathematics is a foundational subject in higher education and a gatekeeper for many academic programs and careers. Poor mathematical performance at the tertiary level can have significant consequences, limiting students' academic progression and future opportunities. Yet universities often treat mathematics courses as standardized, with little investigation into how students' learning preferences interact with

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their performance. In the Philippine context, there is a pressing need to generate evidence that can guide the redesign of mathematics instruction to be more inclusive and effective for diverse learners. Local studies examining this relationship are still sparse, leaving educators with limited data to inform pedagogical innovation.

This study sought to address that research gap by systematically mapping the learning styles of students at Capiz State University and examining how these styles relate to academic performance in mathematics. Using the standardized Grasha-Riechmann inventory, the study collects data from students across two campuses, providing a comprehensive profile of their learning preferences. By correlating these profiles with actual academic performance, the research moves beyond descriptive surveys to test whether learning style-informed differentiation might hold promise for improving tertiary-level mathematics instruction. In doing so, the study aims to provide actionable insights for teachers, curriculum planners, and administrators seeking to raise mathematics achievement.

The contribution of this research is twofold. First, it offers new empirical evidence specific to the Philippine university context, which has been largely overlooked in prior learning-style research. Second, it provides practical, research-based guidance for redesigning mathematics instruction to better align with students' learning preferences. By identifying which learning styles are most prevalent and which are most strongly associated with better performance, the study can inform teacher training, lesson planning, and assessment design. Such insights are essential for moving away from one-size-fits-all instruction toward more personalized, student-centered approaches that can help all learners succeed.

Ultimately, this study not only sought to improve mathematics outcomes at Capiz State University but also aimed to contribute to the broader body of knowledge on differentiated instruction and learning styles in higher education. By rigorously testing the relationship between learning styles and academic performance in a local university setting, the research provides a model for other institutions to conduct similar investigations. It underscores the importance of evidence-based teaching practices and the need for ongoing pedagogical research to ensure that all students—regardless of their preferred learning styles—have equitable opportunities to master essential mathematical skills.

Objectives

This study aimed to investigate the relationship between students' learning styles and their mathematical performance. By mapping these connections, the research sought to provide insights that could guide teachers in creating more effective, customized instructional plans to improve mathematics learning outcomes.

Specifically, the study aimed to answer the following questions:

(1). What were the learning styles of the students?

(2). What was the academic performance of students in Mathematics?

(3). Were there significant relationships between learning styles and academic performance in mathematics?

Hypothesis

Given the stated research problems, the following hypotheses were tested at 0.05 level of significance:

H_0: There is no significant relationship between learning styles and academic performance in mathematics?

H_a: There is a significant relationship between learning styles and academic performance in mathematics?

METHODS

Research Design

This study employed the survey-correlation method of research. Fraenkel and Wallen (2012) described a survey-correlation method combines survey research techniques with correlational analysis to examine the relationship between variables without manipulating them. It used surveys to collect data from a large group and then statistically analyzed the relationships between those variables. This method focused on describing and understanding associations, rather than establishing cause-and-effect relationships.

Population and Sampling

The respondents of the study were the three hundred sixty (360) out of the three thousand six hundred five (3,605) students selected from Roxas City Campus and Pontevedra Campus during the school year 2023 - 2024.

The students were randomly selected using the stratified random sampling. Stratified random sampling were used by drawing the sample from the population and then drawing separate random samples from each stratum

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(Parson et al., 2022). The required number of participants was determined using the formula of Raosoft sample size calculator (Raosoft, 2004). They were selected at random using the stratified proportional sampling by means of drawing of lots. This means that all the names of the students were written in rolled slips of paper and placed in a box. From the box, the required number of respondents was drawn. The names of the students that were drawn from each box served as the participants in the study. The proportional allocation formula was used to get the appropriate sample size from various groups or classes of the population involved in the study.

Data revealed that out of the 360 students, 141 or 39.2% are males and 219 or 60.8% are females. Data showed that majority of the students are females. On the age, it showed that 193 or 53.6% are 16 years old and below; and 167 or 46.4% are more than 16 years old. It revealed that most students are 16 years old and below.

Instrument

Students' Learning Styles. The researcher employed the Grasha –Reichmann Learning Styles Inventory. The questionnaire had 60 questions with 10 questions per learning area. This instrument covered broad context, spanning six learning contents, namely: (a) independent; (b) avoidant; (c) dependent; (d) collaborative; (e) competitive and (f) participative. Items numbers: 1, 7, 13, 19, 25, 31, 37, 43, 49, and 55 were for independent learning contents, while items numbers: 2, 8, 14, 20, 26, 32, 38, 44, 50, and 56 were for avoidant learning. Items numbers: 3, 9, 15, 21, 27, 33, 39, 45, 51, and 57 were for collaborative learning while items numbers: 4, 10, 16, 22, 28, 34, 40, 46, 52, and 58 were for dependent. Items numbers: 5, 11, 17, 23, 29, 35, 41, 47, 53, and 59 were for competitive learning and items numbers: 6, 12, 18, 24, 30, 36, 42, 48, 54, and 60 were for participative learning. The Likert's scale was used in the interpretation of scores to identify students' pronominal or prevalent learning styles.

Each statement was answerable by any of the following responses: 5 "if you always do the statement", 4 "if you oftentimes do the statement", 3 if you seldom do the statement", 2 "if you very seldom do the statement", and 1 "if you never do the statement". For statistical purposes, the following numerical weights were assigned to respective responses:

Weight	*Responses*
5	if you always do the statement
4	if you oftentimes do the statement
3	if you seldom do the statement
2	if you very seldom do the statement
1	if you never do the statement

Prior to its use, the instrument underwent face validation by members of the panel. Once the instrument was faced and content validated, this was pilot tested to thirty (30) students. The result of the pilot testing was used in determining the computer-processed factor analysis, construct validation, and reliability testing of the research instrument using the Statistical Package for Social Science (SPSS) software. Items with factor loadings of .50 and above were included in the instrument while those below .50 were discarded. Tavakol and Dennick (2011) contended that an instrument with a reliability index of .70 and above was considered reliable. The result of the computer-processed factor analysis showed that out of 60 items, all items were included. These items had factor loading which ranged from .507 to .783. On the other hand, the result of Cronbach alpha showed a reliability index of .88. The results of statistical tests indicated that the instrument was reliable and valid.

Academic Performance in Mathematics. For the academic performance in mathematics, a secondary data from the grade sheets of the teachers was drawn. To describe the academic performance of students in mathematics, the scale below was used.

Scale	*Description*
96 - 100	Excellent
91 - 95	Very Good
86 – 90	Good
80 - 85	Satisfactory
75 - 79	Poor

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Data Collection

A standardized instrument—the Grasha-Riechmann Learning Styles Inventory was administered and retrieved personally by the researcher to the 360 students enrolled at the Roxas City and Pontevedra campuses for school year 2023-2024. This is ensure a 100% retrieval of the accomplished copies of the instrument. After retrieval of the questionnaire, the data was tallied, analyzed and interpreted using the appropriate statistical test.

Treatment of Data

The data gathered from the study was analyzed using the Statistical Package for Social Sciences (SPSS) software. The following were the statistical tools used in the analysis of the data gathered.

Mean. This was employed to determine the learning styles of students.

Standard Deviation. This test was used to determine the homogeneity as well as heterogeneity of the teaching styles of teachers and learning styles of students.

Gamma. This test, set at .05 alpha level of significance, was used to determine the relationship of teaching styles, learning styles, and academic performance of students in mathematics.

Ethical Considerations

The researcher ensured that all ethical guidelines were followed, including obtaining informed consent from participants and ensuring the confidentiality and privacy of their responses throughout the study. In order to protect the privacy of the participants, all surveys were completely treated confidentially.

RESULTS AND DISCUSSIONS

Learning Styles of Students

The data in Table 1 show the learning styles of the students. The results showed that the learning styles of students were participative style (M = 3.93, SD = .54), collaborative style (M = 3.90, SD = .57), dependent style (M = 3.83, SD = .51), independent style (M = 3.54, SD = .54), competitive style (M = 3.40, SD = .62), and avoidant style (M = 2.67, SD = .57).

Generally, the preferred learning style of students was the participative style. This indicates that the students are religiously attending to their classes. They are responsible, cooperative, participative in the classroom activities, diligent, and eager to learn.

A study published in Frontiers in Psychology investigated the relationship between learning styles and academic procrastination among students in mathematics. The findings suggested that understanding students' learning styles could help in designing instructional strategies that reduce procrastination and improve academic performance (Wan Hussin & Mohd Matore, 2023).

Table 1
Mean and Standard Deviation of the Learning Styles of Students

Category	Mean	SD
Participative style	3.93	0.54
Collaborative style	3.90	0.57
Dependent style	3.83	0.51
Independent style	3.54	0.54
Competitive style	3.40	0.62
Avoidant style	2.67	0.57

Academic Performance of Students in Mathematics

In Table 2, the academic performance of the students in mathematics is presented. Generally, data showed that the academic performance of the students in mathematics was good (M = 86, SD = 4.7).

Data on the sex of the students showed that males (M = 85, SD = 5.0) had satisfactory academic performance, while females (M = 86, SD = 4.4) had good academic performance.

For the age, students who were more than 16 years old had satisfactory (M = 85, SD = 5.0) academic performance, on the other hand, those 16 years old and below had good (M = 86, SD = 4.4) academic performance.

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The result also showed that students who had low (M = 84, SD = 5.7) and high (M = 85, SD = 5.0) monthly family income had satisfactory academic performance, while those students who had average monthly family income, they had good (M = 86, SD = 4.2) academic performance.

On the whole, the academic performance of the students in mathematics was good. This means that the students find mathematics as a hard subject. The students had learned their mathematics lessons, but it was not enough for them to perform better. Despite having ample time to study and practice, they often neglected to take meaningful steps to enhance their performance.

The result of the study conforms to findings by Zhang et al. (2024), whose longitudinal analysis revealed that regular participation in physical activities positively influenced students' interest in mathematics over time. This suggests that engaging in physical activity may help sustain and enhance students' interest in mathematical subjects.

Table 2

Mean and Standard Deviation of the Academic Performance of Students in Mathematics

Category	Mean	Description	SD
Entire Group	86	Good	4.70
Sex			
Male	85	Satisfactory	5.00
Female	86	Good	4.40
Age			
More than 16 yrs old	85	Satisfactory	5.00
16 years and below	86	Good	4.40
Monthly Family Income			
Low (below 10k)	84	Satisfactory	5.70
Average (10k – 50k)	86	Good	4.20
High (more than 50k)	85	Satisfactory	5.00

Scale	*Description*
96 - 100	Excellent
91 - 95	Very Good
86 – 90	Good
80 - 85	Satisfactory
75 - 79	Poor

Relationships between learning styles and academic performance in mathematics

The relationship of learning style and academic performance in mathematics is shown in Table 3. There was a significant relationship between the learning style and academic performance. These learning styles were the dependent style (Gamma value = .265*, .000 < .05), collaborative style (Gamma value = .181*, .001 < .05), and participative style (Gamma value = .253*, .000 < .05).

Thomas and Mohammed (2024) explored the relationship between students' interest in mathematics and their academic performance. Their study found a positive correlation between students' interest levels and their performance in mathematics, indicating that increased interest was associated with improved academic outcomes. This finding aligns with earlier research suggesting that enjoyment and interest in mathematics contribute to better academic performance

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Table 3

Gamma Results in the Learning Styles and Academic Performance in Mathematics

Variables	Value	Sig.
Learning Style and Academic Performance		
Independent style	0.048	.385
Avoidant style	0.351	.061
Dependent style	.265*	.000
Collaborative style	.181*	.001
Competitive style	0.094	.089
Participative style	.253*	.000

** p < .05 – significant at 5% level*

Conclusions

The preferred learning style of students is participative, indicating that they are active learners in the classroom. Using this style engages students in the learning process, making lessons easier to understand. They favor "hands-on" and "minds-on" learning over listening to lectures from teachers, meaning they prefer learning through doing.

The academic performance of students in mathematics is generally good, suggesting they have acquired the necessary knowledge and skills for learning. However, this may not be sufficient for them to excel further in mathematics. It appears they have not fully mastered the competencies required for mathematics lessons, possibly due to competing priorities.

Students exhibit distinct learning styles, which may result from teachers employing various teaching methods or styles. This diversity enables students to adjust and align with the pace at which teachers deliver lessons. Such a learning mechanism is natural for students as it helps them identify what works best with their teachers' instructional styles.

The academic performance of students in mathematics tends to be similar regardless of the teaching styles employed by teachers. In other words, students share comparable interests, feelings, and attitudes toward mathematics. Their success may be attributed to the positive encouragement, effective classroom management, and equal learning opportunities and activities provided by teachers. Furthermore, differences in academic performance may be linked to students who actively participate in learning activities, in contrast to those who remain passive and disengaged. Teachers may also award extra points to students who demonstrate diligence, responsibility, and cooperation during discussions. It is clear that students' learning styles can influence how they absorb lessons, and they tend to learn more effectively and quickly when they engage with their preferred learning methods.

Recommendations

Students are advised to study hard to improve their math skills. Furthermore, to boost their academic performance, students are encouraged to participate actively in discussions and diligently complete the learning tasks or activities assigned by their teachers. They should also seek assistance from teachers if they find the lessons challenging. In this way, teachers can demonstrate warmth, openness, and helpfulness, which can prevent discouragement among students. This approach may foster a sense of belonging among students in the classroom.

Parents should consistently encourage their children to excel in school. They should remind their children to participate in all school activities. When faced with learning difficulties, children should view these challenges as opportunities for growth that will help them become more mature and responsible individuals. Greater motivation and support from parents will ultimately benefit their children.

We recommend conducting related studies to enhance the academic performance of students in mathematics. Future researchers may introduce additional variables not considered in this study to enhance students' academic performance in mathematics.

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