# Students' Learning Styles and General Mathematics Achievement: Basis for the Development of Strategic Intervention Material

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**DOI: https://dx.doi.org/10.47772/IJRISS.2026.100300632**

**Received: 02 April 2026; Accepted: 08 April 2026; Published: 22 April 2026**

## ABSTRACT

This study determined the learning styles and General Mathematics achievement of Grade 11 students in Congressional District 4 of Batangas Province for the School Year 2024-2025. The study used a quantitative-descriptive research design and utilized two instruments, Kolb's Learning Style Inventory and a researcher-made test. Three hundred sixty-four respondents were determined through the use of the Raosoft sample size calculator with a 5 percent margin of error.

Results revealed that the General Mathematics achievement of the students under the Academic and TVL Tracks falls under the category Did Not Meet Expectations. Most of the students under the Academic track prefer a Divergent Learning Style, while students in the TVL track prefer an Accommodating Learning Style. There is a significant association between the students' learning styles and their Senior High School (SHS) Tracks, the Academic and TVL Tracks. However, there is no significant association between the General Mathematics achievement and the students' learning styles. Consequently, the proposed Strategic Intervention Material (SIM) was based on the identified least mastered competencies in the General Mathematics test and the dominant learning styles of the Academic and TVL students.

**Keywords:** learning styles, General Mathematics achievement, strategic intervention material

## INTRODUCTION

With the implementation of the K to 12, curriculum planners envisioned promoting globally competitive students. However, the results of the assessments revealed that students were unable to meet the competencies in the curriculum.

The Philippines' first participation in the Program for International Student Assessment (PISA) in 2018 revealed the current situation of the mathematical achievement of the students. The Philippines ranks 78th out of 79 participating countries in Mathematics. The country accumulated a mean score of 353 in Mathematics, a mean which is lower than the OECD's indicated mean, which is 489 (OECD, 2019). Consequently, the 2022 PISA results showed that the Philippines ranks 76th out of 81 participating countries in Mathematics with an average score of 355, lower than the OECD mean score of 472 (OECD, 2023). This result indicates low performance and insufficient knowledge and skills to answer the given assessment.

On the other hand, the National Achievement Test (NAT) results in 2019 showed a decrease in the proficiency level of the Grade 12 students (Behiga, 2022). The decrease in the mathematical performance level implies that the students did not fully meet the target competencies set for their mathematics subjects.

Additionally, the conducted NAT in 2024 revealed that the proficiency level of the students in the Batangas Province falls under the category "Low Proficient," which comprises 71.68% of the total number of students who took the examination (DepEd, 2024). With the continuous decline in the performance of the students in Mathematics, a need to develop an intervention material that would address the learning difficulties encountered by the students arises.

The low performance of the students in Mathematics could be attributed to many factors. One of these factors is the students' learning styles. According to Ignacio and Reyes (2017), learning style refers to the students' preference in learning. Since they are unique from one another, they have different ways and approaches to learning. When teaching approaches correspond with students' preferred learning styles, learners may find it easier to understand mathematical concepts, participate actively in classroom activities, and develop deeper conceptual understanding, which may ultimately lead to improved academic performance.

Although education in the 21st century emphasizes the integration of technology, innovation, and flexible learning environments, understanding students' learning styles remains an important consideration in effective teaching and learning. The modern classroom is characterized by diverse learners who possess varying cognitive preferences, prior knowledge, and learning experiences. As a result, a one-size-fits-all instructional approach may not effectively address the needs of all learners. Studying students' learning styles provides valuable information that enables teachers to recognize these individual differences and adjust their instructional methods accordingly. In mathematics education, where abstract concepts and problem-solving skills are essential, understanding how students prefer to learn can help teachers design activities that facilitate conceptual understanding, promote critical thinking, and enhance engagement.

Furthermore, identifying students' learning styles supports the implementation of differentiated instruction, which is a key principle in 21st-century education. By recognizing whether students learn more effectively through visual representation, conceptual analysis, hands-on experiences, or reflective observation, teachers can employ varied instructional strategies that address multiple learning preferences. This approach encourages greater student participation and allows learners to construct knowledge more meaningfully. In addition, knowledge of students' learning styles can guide teachers in providing targeted remediation and enrichment activities, particularly for topics that students find difficult in General Mathematics.

In Congressional District 4 of Batangas Province, there is no known study that examines the relationship between students' learning styles and their achievement in General Mathematics. Hence, this study was conducted to determine the students' preferred learning styles and to examine their association with achievement in General Mathematics. The findings of this study are expected to provide insights that may assist teachers in designing instructional strategies and developing interventions, such as Strategic Intervention Materials (SIM), that are responsive to students' learning preferences and needs.

**Objectives**

The purpose of this study was to develop a strategic intervention material aligned with the identified least mastered competencies in General Mathematics and students' learning styles.

Specifically, it aimed to answer the following objectives:

1. determine the General Mathematics achievement of the students under:
    1.1 Academic Track; and
    1.2 Technical-Vocational-Livelihood (TVL) Track;
2. assess the learning styles of the respondents;
3. determine if there is a significant association between the students' learning styles and Senior High School (SHS) Tracks;
4. determine if there is a significant association between the students' learning styles and General Mathematics achievement of the Academic and TVL Tracks; and
5. prepare strategic intervention material in General Mathematics.

### Hypotheses

This study tested the following null hypotheses:

1. There is no significant association between the students' learning and SHS Tracks; and
2. There is no significant association between the students' learning styles and General Mathematics achievement.

## METHODOLOGY

### Research Design

The study utilized a quantitative-descriptive design to determine the respondents' preferred learning style and assess the General Mathematics achievement. This method was used because the study focuses only on providing information on the relationship between the said variables without manipulating and implying causation (Slater and Hasson, 2025).

### Respondents of the Study

The respondents of the study were the Grade 11 Senior High School students SY 2024-2025 from the public schools of Congressional District 4 in Batangas Province. Three hundred sixty-four respondents from the Academic and TVL Tracks were chosen using the Raosoft sample size calculator with a 5% margin of error. Stratified random sampling was used to determine the number of respondents in each Sub-Office, which serves as the stratum.

**Table 1. Distribution of the Grade 11 Students in Congressional District 4**

| SUB-OFFICES | SHS TRACKS | | | | TOTAL | |
|---|---|---|---|---|---|---|
| | ACADEMIC | | TVL | | | |
| | N | n | N | n | N | n |
| Ibaan | 650 | 36 | 195 | 11 | **845** | **47** |
| Padre Garcia | 887 | 49 | 119 | 7 | **1006** | **56** |
| Rosario East | 369 | 20 | 69 | 4 | **438** | **24** |
| Rosario West | 542 | 30 | 95 | 5 | **637** | **35** |
| San Jose | 625 | 34 | 38 | 2 | **663** | **36** |
| San Juan East | 957 | 53 | 294 | 16 | **1251** | **69** |
| San Juan West | 733 | 40 | 183 | 10 | **916** | **50** |
| Taysan | 703 | 39 | 159 | 8 | **862** | **47** |
| **TOTAL** | 5466 | 301 | 1152 | 63 | **6618** | **364** |

Legend: N-Total Population, n-Sample Size

### Data Gathering Instruments

The researcher used a validated researcher-made test and Kolb's Learning Style Inventory (KLSI) as the tools for gathering data. For better understanding, the construction, validation, administration, and scoring of the tools were discussed specifically.

### Researcher-Made Test

To collect the necessary information for the General Mathematics achievement of the respondents, the researcher made a test about the topics covered in General Mathematics. This test is a multiple-choice test and is based on the Most Essential Learning Competencies (MELCs). The topics included in the test are Functions and their Graphs, Business Mathematics, and Logic. This was used to determine the level of achievement of the respondents in General Mathematics and the respondents' mastery of the indicated learning competencies.

**Kolb's Learning Style Inventory**

To determine the dominant learning styles of the respondents, the researcher used KLSI. The inventory is a standardized test made by David A. Kolb, and it classifies the learning styles into accommodators, assimilators, convergers, and divergers.

**Construction.** Before constructing the test items, the researcher made the Table of Specifications (TOS), a test blueprint. All the learning competencies in the MELCs were included in the TOS. Each test item was categorized based on Bloom's Taxonomy (remembering, understanding, applying, analyzing, evaluating, and creating). The TOS served as a guide in making a multiple-choice test.

Kolb's Learning Style Inventory (KLSI) is a standardized test.

**Validation.** To determine the content validity and internal validity of the researcher-made test, the instrument was evaluated by the experts in the field of study. Six validators validated the researcher-made test. The comments and suggestions of the validators were taken into consideration to improve the test.

A pilot test was conducted to determine the reliability of the researcher-made test. Using Cronbach's alpha and Kuder-Richardson Formula 20 (KR 20), results showed that the researcher-made test has an internal reliability of 0.76. This means that the researcher-made test is acceptable and can be used in determining the level of achievement of the respondents in General Mathematics.

Meanwhile, the validity and reliability of Kolb's Learning Style Inventory (KLSI) using Cronbach's alpha range from 0.77 to 0.82 (Cabaces, 2024). This makes the KLSI a valid tool in determining the preferred learning style of the respondents.

**Administration.** Upon approval and endorsement of the SDS of Batangas Province, the researcher personally sought permission from the School Heads of the schools. As the school heads gave permission for the administration of the KLSI and the researcher-made test, the researcher personally explained the objectives and the instructions for answering the researcher-made test to the respondents. The researcher retrieved the copies after the respondents completed answering the data gathering tools.

**Scoring of Responses**. The scoring guides used in determining the General Mathematics achievement and level of mastery are shown below:

| Scale/Percentage | Verbal Interpretation |
|---|---|
| 90–100 | Outstanding |
| 85–89 | Very Satisfactory |
| 80–84 | Satisfactory |
| 75–79 | Fairly Satisfactory |
| 74 and below | Did Not Meet Expectations |

Source: DepEd Order No. 8, s.2015

To determine if the learning competencies included in the MELCs in General Mathematics in the given items are mastered by the students, the scale below was used and incorporated in the item analysis:

| Scale/Range | Verbal Interpretation |
|---|---|
| 75 and above | Mastered |
| 50–74 | Nearing Mastery |
| 49 and below | Not Mastered |

In scoring the KLSI individually, the researcher followed the scoring in the adapted instrument. There are four columns, labeled A to D, in the given learning style inventory for the respondents with different phrases. The students will check the phrase that best describes them. After checking 10 sets of four different phrases, the total

number of checks will be counted. The number of checks obtained from Column B will be subtracted from the total number of check phrases in Column A. Then, the total number of checked items from Column D will be subtracted from the number of checks in Column C. The difference was considered as an ordered pair (A-B, C-D), which was plotted against the KLSI quadrant. The plotted points were then connected, and the quadrant from which the line lies is the preferred learning style.

**Data Gathering Procedure**

The researcher used the researcher-made test and KLSI to determine the achievement of the respondents in General Mathematics and identify the learning style. Before the distribution of the validated researcher-made test and KLSI, the researcher sought approval from the SDS of the Division of Batangas Province. As the request was approved and an endorsement was issued, the researcher administered the validated researcher-made test and KLSI to schools in Congressional District 4.

The researcher gathered all the responses and encoded them in Microsoft Excel. Appropriate statistical treatment, such as the frequency count, percentage, mean, standard deviation, Fisher's exact test, and Chi-square test of independence, was used in analyzing the data.

On the other hand, to determine the least mastered competencies in General Mathematics, the item analysis was used by the researcher. Separate analyses in the Academic and TVL tracks were made by the researcher. If more than one competency is classified as "not mastered", the average of the test items was compared, and the lowest average was noted as the least mastered competencies in the Academic and TVL students.

To validate the identified least mastered competencies, an interview was conducted with General Mathematics teachers. Interview guides were used by the researcher to interview General Mathematics teachers. Furthermore, the interview served as a guide in identifying the specific parts of the identified least mastered competencies that students find difficult.

**Statistical Treatment of Data**

The collected data were presented in tabular form. The following statistical tools were used in analyzing the data.

**Chi-Square Test of Independence**. This was used to determine the significant association between the learning styles of the respondents and their SHS Tracks, Academic and TVL Tracks. This was also used to determine the significant association between the academic students' learning styles and their level of achievement in General Mathematics.

**Fisher's Exact Test.** This was used to determine the significant association between TVL students' learning styles and their level of achievement in General Mathematics.

**Frequency Count**. This was used to determine the number of respondents in each learning style and the number of respondents in each level of General Mathematics achievement. This was also used in determining the number of correct responses in each item in the researcher-made test.

**Mean.** This was used to determine the average of the respondents' scores in the General Mathematics test.

**Standard Deviation**. This was used to determine the spread or variability of the scores of the respondents from the mean.

**Percentage.** This was used to determine the proportion of the respondents classified under each learning style and level of General Mathematics achievement. Moreover, this was also used to determine the percentage of correct responses in the researcher-made test.

**Ethical Consideration**

Before the study was conducted, a formal letter was given to the SDS of Batangas Province. Upon the approval and issuance of the endorsement, the researcher personally seeks permission from the School Heads of the public schools in Congressional District 4.

With the approval of the school heads, the Grade 11 respondents were informed by the researcher about the study, and consent was given. After the parents/guardians signed the consent form, the respondents were given the researcher-made test and the KLSI.

The researcher assured the respondents that all the data collected would be handled with the utmost confidentiality. Additionally, no aspect of the results includes any information about the respondents' identities or the schools they attend. Furthermore, the provisions in the Data Privacy Act of 2012 were observed in the conduct of the research.

## RESULTS AND DISCUSSION

**General Mathematics Achievement of the Students**

The General Mathematics achievement of the students was assessed using a validated researcher-made test. The equivalent percentage of the students' scores in the test was determined by means of dividing the raw score by 45 and multiplying the quotient by 100. The result was then classified based on the classifications indicated in the DepEd Order No. 8, s. 2015. Tables 2 and 3 present the data.

**Academic Track**

This track in SHS consists of the following strands: ABM, HUMSS, and STEM. Students under this track focus on the academic subjects; hence, the curriculum in the strand offers subjects that develop their comprehension, analysis, and problem-solving. Table 2 shows the details on this.

**Table 2. Level of the General Mathematics Achievement of the Academic Track Students**

| Interpretation | Frequency | Percentage |
|---|---|---|
| Outstanding | 23 | 7.64 |
| Very Satisfactory | 27 | 8.97 |
| Satisfactory | 13 | 4.32 |
| Fairly Satisfactory | 18 | 5.98 |
| Did not Meet Expectations | 220 | 73.09 |
| **Total** | **301** | **100** |

Mean=60.69(Did not Meet Expectations); SD=8.567; Min=24.44(Did not Meet Expectations); Max=100 (Outstanding)

From a total of 301 students under the Academic Track, the table shows that more than half of the students fall under the category Did not Meet Expectations (73.09%). Although students under the Academic track have subjects that focus on enhancing their competency level in Mathematics, the data revealed that students were unable to meet the required competencies in General Mathematics.

The overall mean of 60.69 indicates that the Academic Track students did not meet expectations. This level shows that the academic students lack mastery of the General Mathematics competencies. This is consistent with the study of Mamolo (2019), indicating that students still lack knowledge and mastery in the subject. Furthermore, the standard deviation of 8.567 showed a high variability of scores, signifying that students under the Academic Track have varying achievements with one another. This varying achievement of the students is evidently shown by the minimum and maximum values, which are 24.44 and 100, respectively.

The variations in the scores of the academic students may be associated with their differences, especially in the strands they belong to. Each strand in SHS has its own specializations, which develop the skills of the students

in specific disciplines (DepEd, 2019). The strands under the Academic Track are ABM, HUMSS, and STEM. These three tracks have different curriculum designs and focus that is why most of the students' abilities and skills differ from one another.

In the ABM strand, there is a specialized subject, Business Mathematics, which further deepens the students' understanding of solving business-related problems (Alova and Calanza-Alova, 2022). This could be one of the possible reasons why some of the ABM students know the formula and strategies for solving problems in the given General Mathematics test. Having practice and additional lessons in mathematics helps the students to have longer retention of the lesson. Since General Mathematics has a Business Mathematics topic in the second quarter, the students' knowledge and skills in solving business-related problems were strengthened. It provides them with a deeper understanding of the concepts that help them answer the test items more confidently compared to other strands.

Meanwhile, in the HUMSS strand, there are no additional Mathematics subjects that will help them practice applying mathematical concepts. The specialized subjects in HUMSS are designed to improve students' skills in analyzing situations in the human aspect, culture, and society. Though they have an advantage in conceptual knowledge and analyzing situations, applying this in solving math problems would be hard if there is a lack of math concepts and low arithmetic proficiency.

For the STEM strand, students have specialized subjects that help them enhance their critical-thinking and problem-solving skills. The strand is designed to help the learners be equipped with skills that can analyze and deal with abstract concepts; hence, they have an advantage when it comes to solving problems. Moreover, students under this strand have grades in Science and Mathematics in Grade 10 that are above 85, enabling them to excel in answering the General Mathematics test.

**Technical-Vocational-Livelihood (TVL) Track**

This track consists of the following strands: HE, IA, and ICT strands. The curriculum in this track ensures students' development of practical skills needed to enter the workforce.

Table 3 shows that most of the TVL students, 92.06%, did not meet the target competencies in General Mathematics. The results suggest that the students under the TVL track perform poorly in mathematics. Since the subjects taken by the TVL students focus on developing and enhancing technical skills, students encounter difficulties when dealing with Mathematics (Akbar, 2020). The subject requires conceptual understanding and manipulation of formulas, which the students are not trained to do.

**Table 3. Level of the General Mathematics Achievement of the TVL Track Students**

| **Interpretation** | **Frequency** | **Percentage** |
|---|---|---|
| Outstanding | 0 | 0 |
| Very Satisfactory | 1 | 1.59 |
| Satisfactory | 1 | 1.59 |
| Fairly Satisfactory | 3 | 4.76 |
| Did not Meet Expectations | 58 | 92.06 |
| **Total** | **63** | **100** |

Mean=49.44(Did Not Meet Expectations); SD=5.587; Min=24.44 (Did not Meet Expectations); Max=86.67 (Very Satisfactory)

The overall mean of 49.44, which falls under the classification Did Not Meet Expectations, showed that TVL students performed low on the General Mathematics test. This could be associated with the different factors, such as having a weak foundation of the fundamental concepts in mathematics.

The standard deviation of 5.587 indicates that the scores of the students have moderate variability. It can be seen from the minimum and maximum percentage scores, which are 24.44 and 86.67, respectively. This suggests that students in the TVL track have varying knowledge and skills when compared to one another.

The moderately spread values of the scores from the test indicate that some students understand the lesson better than others. Although they passed their mathematics subject in their JHS years, their knowledge and skills are not enough to answer the given assessment. Application of the concepts learned in previous mathematics subjects in General Mathematics is hard for the students because they were not able to learn the concept and apply it properly. Lack of mastery of the fundamental concepts, such as the basic operation hinders the students from learning higher and complex mathematical concepts.

Thus, Table 2 and Table 3 revealed that the achievement of the Academic and TVL students was both classified under the same category, Did Not Meet Expectations. These tracks, after taking General Mathematics, failed to learn and meet the expected learning competencies in General Mathematics. This can be associated with the students' weak foundation in the fundamental concepts of mathematics. Acquiring only a minimum knowledge from their previous mathematics subject limits their ability to learn complex and higher mathematical concepts.

**Assessment of the Learning Styles of the Respondents**

The assessments of the respondents regarding the dominant learning styles in the Academic and TVL tracks are shown in Tables 4 and 5.

**Table 4. Learning Styles of the Academic Track Students**

| **Learning Style** | **Academic Track** | |
|---|---|---|
| | **Frequency** | **Percent** |
| Diverger | 115 | 38.21 |
| Accommodator | 80 | 26.58 |
| Converger | 60 | 19.93 |
| Assimilator | 46 | 15.28 |
| **Total** | **301** | **100** |

From a total of 301 students in the Academic Track, the majority of the students are Divergers (38.21%). This means that most of the students in the Academic Track prefer to listen, observe, and reflect before making any actions or decisions (Cabaces, 2024; Akbar, 2020; Villajuan, 2019).

Divergers are students who learn best using a combination of concrete experience and reflective observation (Rohmanawati, 2021). This learning style fits the description of the Academic Track students because they can assess the situation from different viewpoints, and they prefer being logical and rational. They are focused on generating information based on brainstorming and other ways of gathering data, seeing the long-term implications of things, viewing concrete solutions from different points of view, and seeing the connections of different subjects being studied.

On the other hand, the assimilator is the least preferred learning style of the Academic Track students. Assimilators prefer to learn using a combination of abstract conceptualization and reflective observation. Since most of the students were having a hard time understanding abstract concepts, only a few students have this learning style.

Table 5 provides an overview of the TVL track students' learning styles.

**Table 5. Learning Styles of the TVL Track Students**

| **Learning Style** | **TVL Track** | |
|---|---|---|
| | **Frequency** | **Percent** |
| Diverger | 20 | 31.75 |
| Accommodator | 29 | 46.03 |
| Converger | 6 | 9.52 |
| Assimilator | 8 | 12.70 |
| **Total** | **63** | **100** |

TVL students showed a large percentage as Accommodators, comprising 46.03%, and the least preferred learning style is Converger (9.52%). The description for accommodators fits the TVL learners because they like to involve themselves in hands-on activities and practical tasks to learn the lesson, rather than focusing on sitting and applying concepts in answering mathematical problems.

The result further clarifies that TVL students are practical learners, and they prefer to learn by doing. This is the reason why the curriculum of the TVL students focuses on improving the skills of the students. The hands-on activities provide them with a clear picture of the scenario, enabling them to learn easily. Through hands-on activities, they can make trials and act based on their intuition.

On the other hand, the convergers prefer a combination of abstract conceptualization and active experimentation. Since most of the TVL students focus on the actual skill performance and competency tasks, they are less trained to apply concepts and theories to problem-solving. Focusing on abstract concepts is hard for them since the curriculum designed for the TVL track students is intended for developing their skills Quinazo et al., 2025).

**Association between the Students' Learning Styles and Senior High School (SHS) Tracks**

Table 6 shows the distribution of the learning styles in the Academic and TVL tracks. From the table, it can be noted that the Academic track prefers a divergent learning style, while the TVL students prefer to be accommodators. With $\chi^2=10.52$, p-value=0.01, the data revealed that there is a significant association between the learning styles of the Academic and TVL students. This means that the distribution of the learning styles from the Academic track is different from the TVL track.

**Table 6. Association between the Learning Styles and SHS Tracks**

| Variables | $\chi^2$ | df | p-value | Decision on $H_o$ | Interpretation |
|---|---|---|---|---|---|
| Learning Styles* SHS Tracks | 10.52 | 3 | .01 | Reject | Significant |

Although students are unique, they exhibit similar behavior when they are grouped based on the enrolled track (Mamolo, 2019). Exposing students to the same learning tasks increases the chance that they will adapt to the changes and exhibit similar behavior within their group. Academic students focused on theories and concepts, thereby making them able to analyze and interpret the data logically.

The result of the present study shows the academic students tend to be more problem-solvers wherein they are more on theory or conceptual based. They use these skills because academic subjects focus on theories and concepts to solve a given situation or problem. Most of the students in the Academic track are logical thinkers, which is why mathematical concepts can be applied properly.

On the other hand, students under the TVL track are focused on skills, which makes them prefer an accommodative learning style. This learning style focuses on hands-on and practical applications, wherein the learners tend to learn more if they are experiencing the actual scenario of the situation.

**Association between the Students' Learning Styles and General Mathematics Achievement**

The association between the students' learning styles and General Mathematics achievement is shown in Tables 7 and 8.

The data from Table 7 shows the association between the academic students' learning styles and their General Mathematics achievement.

**Table 7. Learning Styles and General Mathematics Achievement of the Academic Students**

| Variables | $\chi^2$ | p-value | Decision on $H_o$ | Interpretation |
|---|---|---|---|---|
| Learning Styles* General Mathematics Achievement | 4.49 | .610 | Failed to Reject | Not Significant |

With $\chi^2 = 4.49$ and $p - value = .610$, the data revealed that there is no significant association between the students' learning styles in the academic track and General Mathematics achievement. This suggests that there are other factors to consider in assessing the students' performance and way of answering the given assessment in General Mathematics.

This may be connected with the nature of General Mathematics, which requires a combination of conceptual understanding, procedural skills, and problem-solving abilities. These skills and abilities are a combination of one or more learning styles, and that is why some of the students encountered difficulties while answering the test. Furthermore, a weak foundation in mathematics also plays an important role in shaping and molding the mathematical abilities of the students.

On the other hand, Table 8 displays the association of the TVL students' learning styles with their General Mathematics achievement.

**Table 8. Learning Styles and General Mathematics Achievement of TVL Students**

| Variables | p-value | Decision on $H_0$ | Interpretation |
|---|---|---|---|
| Learning Styles*<br>General Mathematics Achievement | >.05 | Failed to Reject | Not Significant |

Due to the small sample size and the absence of TVL students in most of the categories in the level of achievement, Fisher's exact test was used. Based on the result, it can be noted that there is no association between the learning style and the General Mathematics achievement of the TVL students. This suggests that learning style alone does not affect the students' achievement in General Mathematics because there are other factors that still need to be considered in understanding and analyzing students' mathematical achievement. However, it is important that the intervention materials should cater to all the learning styles of the students so that they can understand the lesson and make meaningful learning from it.

**Preparation of Strategic Intervention Material in General Mathematics**

The SIM is a tool used by teachers to enhance and develop the mathematical skills of the students. The intervention or remediation provides the learners with time to fully understand and grasp the lesson. This is constructed in a way that it helps the learner to meet the required learning competencies.

The result of the conducted General Mathematics test showed that the Academic and TVL students did not meet the required learning competencies in General Mathematics for a given period of time. Most of the students, both the Academic and TVL students, fall under the "Did not Meet Expectations" category, which comprises 73.09% and 92.06%, respectively. The large percentage of students who do not meet the required learning competencies in General Mathematics challenges the teachers and curriculum planners on how to solve the current situation.

On the other hand, the result of the item analysis in the conducted General Mathematics test revealed that there are some competencies in General Mathematics that the students were not able to master. Moreover, students encountered difficulties in applying the concepts and evaluating the equations and problems in the given General Mathematics test.

The identified least mastered competencies of the Academic and TVL Track students are: determining the truth values of propositions, and solving rational equations and inequalities. The Item Analysis also showed that the learners' understanding of the concept is too low. It means that they need remediation or intervention to supplement their knowledge and concepts in mathematics.

In the SIM, the Guide Card for the Academic and TVL Tracks contains the identified least mastered competency in the given assessment. To verify if the identified least mastered competencies of the students are the lessons that students find hard to understand in the classroom, the researcher conducted an interview with General Mathematics teachers.

According to the interviewed General Mathematics teachers in Congressional District 4, solving rational equations and inequalities is one of the many learning competencies that TVL students find hard to understand. Pre-requisite concepts needed in the study of rational equations and inequalities were not learned by the students, and with that, proceeding to the next higher concept is difficult. Because of this, teachers need to do recall and reteach of the concepts, such as knowing how to determine whether the expression is rational or not, simplifying rational equations, factoring polynomials, and finding the LCD. This reteaching of concepts is important for the students so that they can apply the steps in solving rational equations and inequalities properly.

The teachers also added that some students do not know how to factor polynomials. Unable to factor the polynomials would make the solution for the rational equation and inequality hard to find. The FOIL method, distribution of terms, the correct sign of the integers, and even multiplying or dividing numbers were not fully mastered by the students.

Since TVL students are accommodators, it would be hard for the students to understand these abstract and complex concepts in General Mathematics. Accommodators are hands-on and practical learners, which is why solving abstract concepts would be hard for them.

On the other hand, the Academic students are divergers. They learn best through concrete experience and reflective observations. Based on the interviewed teachers, determining the truth values of the propositions is new to most of the students, which is why they cannot apply the concept easily to the lesson. They need more time to analyze and study logic concepts. Some students find difficulties in analyzing the statement, which results in the wrong translation of statements in symbolic form. Other students were confused about the truth tables as to when and how letters or the symbolic form get a True or False interpretation.

Additionally, some of the schools were not able to teach the Logic topic to students because of the limited time. The First Quarter of the school year, which is about dealing with Functions and their Graphs, and the Second Quarter, which primarily focuses on dealing with Business Mathematics and Logic, may not be followed due to difficulties of the students in understanding the concepts. Teachers cannot proceed to the next lesson if students are not able to understand the topic. Intervention and remediation were first conducted.

Too many learning competencies for 80 hours per semester are not enough to teach the most essential learning competencies. The teachers need to do recall and reteaching of the concepts, which consumes a lot of time. Topics included in General Mathematics are abstract and complex. Students with not enough foundation in these skills encountered difficulties in understanding and applying the concepts.

With this, the General Mathematics SIM included the identified least mastered competencies in General Mathematics in Academic and TVL Track students. Separate SIMs were made for the two tacks which include their dominant learning styles.

The Academic Track students are divergers, and the identified least mastered competencies are about the determination of the truth values of the proposition. The activities made for these students will engage the learners to have reflective observations and concrete experiences that will help them have a deeper understanding of logic topics.

On the other hand, TVL Track students are accommodators; they are practical learners who learn best by doing. The constructed SIM incorporates activities that will help them apply and test their understanding of solving rational equations and inequalities in daily life.

## CONCLUSIONS

In light of the foregoing findings, the following conclusions are drawn.

1. The General Mathematics achievement of the students under the Academic and TVL Tracks falls under the classification Did Not Meet Expectations.
2. Most of the students under the Academic Track prefer a Divergent learning style, while students in the TVL Track prefer an Accommodating learning style.

3. There is a significant association between the students' learning and SHS Tracks.
4. There is no significant association between the students' learning styles and General Mathematics achievement.
5. The Strategic Intervention Material (SIM) is a track-specific material that is based on the dominant learning styles of the SHS students.

Although there is no significant association between the students' learning styles and General Mathematics achievement found in the study, students' learning styles are an important factor to consider when making activities or interventions to help students address their learning difficulties and promote inclusive and meaningful experiences among the learners.

## ACKNOWLEDGEMENTS

The researcher would like to express her sincere gratitude to all individuals and institutions who contributed to the completion of this study. Special thanks are extended to the participants for their time and cooperation, as well as to the school administrators and teachers for their support and assistance in data collection.

The researcher also acknowledges the guidance and encouragement of her mentors and colleagues, whose insights greatly improved the quality of this research. Finally, heartfelt appreciation is given to family and friends for their unwavering support throughout the research process.

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# APPENDIX

## APPENDIX A

### Academic Students Activity Card

## SPOT THE INCORRECT SYMBOL

**Directions**: Spot the incorrect symbolic translation and write the appropriate symbol.

**Card A**

If Maria studies, then she passes.

**Let**

**p: Maria studies**

**q: She passes**

**Given Answer: $p \wedge q$**

**Card B**

The student will receive a grade if and only if he submits the project.

**Let**

**p: The student will receive a grade**

**q: The student submits the project**

**Given Answer: $p \vee q$**

**Card C**

Either the company does not prepare a proper budget or it does not gain profit.

**Let**

**p: The company prepare a proper budget**

**q: The company gains profit**

**Given Answer: $(\sim p) \rightarrow (\sim q)$**

**APPENDIX B**

**Technical-Vocational-Livelihood (TVL) Students Activity Card**

# Solving Rational Equations

**Directions**: Solve for x in the given rational equation.

| **RATIONAL EQUATION** | $\frac{2}{x+1}=\frac{1}{x}$ | $\frac{x}{x^2-4}-\frac{1}{x-2}=\frac{2}{x+2}$ |
|---|---|---|
| 1. Identify restricted values | | |
| 2. Find LCD | | |
| 3. Clear the fractions | | |
| 4. Solve | | |
| 5. Checking | | |