

## Difficulties and coping strategies in understanding mathematical concepts in a private higher education in Tagum City, Davao del Norte, Philippines

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**ABSTRACT.** Understanding mathematical concepts involve developing an intuitive grasp of the underlying ideas and principles that govern mathematical operations and relationships. The primary purpose of this study is to investigate the difficulties and coping strategies in understanding mathematical concepts. This study used an explanatory sequential research design through the collection and analysis of quantitative data followed by a qualitative inquiry. To collect data, the researchers developed questionnaires for the quantitative and qualitative inquiries, which were validated by external experts. The sample of the study for the quantitative part included conveniently selected 297 students from a private Higher Education Institution (HEI) in Tagum City, Davao del Norte, Philippines, in the academic year 2017-2018. In addition, seven (7) individuals participated in the Key Informant Interviews (KIIs). One session of Focus Group Discussion (FGD) was also organized with seven first-year students enrolled during the second semester of S.Y. 2017-2018. Five skills areas were examined: number fact, arithmetic, language, informational, and visual. Based on the results, students find difficulties in understanding mathematical concepts, specifically in visualizing mathematical concepts and manipulating geometrical shapes and spaces meaningfully. The students also demonstrated difficulties in analyzing the problem, understanding the concept, identifying the correct solution, establishing the equation, and simplifying the expression. In addition, the students cope with the difficulties through self-perseverance, expert consultation, reading and studying, constant practice, and confidence building. Mathematics teachers are recommended to design need-based teaching strategies to optimize student learning.

**Keywords:** *descriptive statistics, higher education, mathematics, Philippines, Tagum City*

## INTRODUCTION

Mathematics learning has been described as a difficult undertaking (Brezavšček et al., 2020; Bringula et al., 2021). It is a challenge that requires ongoing attention and intervention from educators, policymakers, and researchers. By addressing foundational skills, improving teaching methods, promoting positive attitudes towards mathematics, and addressing mathematics difficulties, we can help students to overcome their difficulties with mathematics and develop the skills and confidence needed to succeed in this field.

In Malaysia, the study by Mokhtar et al. (2019) showed that students have difficulty understanding the keywords and fail to convert to the correct mathematical sentence, mathematics comprehension, and basic concepts, and do not like to read long questions. Narratives of mathematics difficulty were also reported in Indonesia, where students faced difficulties in solving numeracy problems, placing unit number values, and distinguishing the symbols of counting operations (Sakilah et al., 2018). In addition, it showed that students have a lack of interest in reading math problems or practicing mathematical skills.

In the Philippines, students have difficulty in comprehension, selecting a strategy, computing the problem, and careless solving skills (Mangulabnan, 2016). Preclaro's (2019) study also showed that Filipino students have learning difficulties such as retrieving mathematics facts, mathematics language, and solving word problems. In addition, it revealed that students faced various challenges in learning mathematics, including difficulty in comprehending the problem, selecting a strategy, and careless solving skills.

This study was conducted to determine the proficiency level of understanding mathematical concepts of the students in a Private Higher Education in Tagum City, Davao del Norte, Philippines. Specifically, this presents a quantitative survey investigating the students' level of difficulties in understanding mathematical concepts in terms of number facts, arithmetic, information, language, and visual-spatial skills. The present study also sought to explore the students' challenges and coping strategies in mathematics learning qualitatively.

## METHODOLOGY

### *Research Design*

This study used an explanatory sequential research design characterized by the collection and analysis of quantitative data followed by the qualitative inquiry to explain and interpret the quantitative results (Creswell, 2009). The quantitative survey was conducted to determine the level of difficulty of students in understanding mathematical concepts. Also, a qualitative inquiry was conducted to investigate the challenges and coping strategies in understanding the mathematical concepts of students.

### *Study Participants*

This study was conducted at a private Higher Education Institution (HEI) in Tagum City, Davao del Norte, Philippines, during the

academic year 2017-2018. The respondents of this study were first-year students enrolled during the second semester of 2017-2018. They were chosen as respondents based on their enrollment in mathematics courses and because they showed difficulties understanding mathematical concepts. A total of 297 students responded to the quantitative survey, as shown in Table 1.

In the qualitative interviews, a total of fourteen (14) selected individuals from the eight (8) courses or disciplines participated. Seven (7) participants for the key informant interviews (KIIs) and seven (7) participants for one session of focus group discussion (FGD). The interview consisted of questions that enabled the researchers to expose or reveal the root cause of their difficulties in understanding mathematical concepts.

**Table 1.** Respondents of the quantitative survey by fields of study or specialization.

Programs	No. of Respondents
Teacher Education	56
Criminology	75
Arts and Sciences	17
Engineering	24
Hospitality and Tourism	21
Accounting	17
Business Administration	87
<b>Total</b>	<b>297</b>

### Research Instruments

The study utilized two research instruments. In the quantitative part, a researcher-made test was administered after the validation by an expert in the field of mathematics. The tool comprised 25 items on a five-point Likert-type response format having values ranging from very high (5) to very low (1). Five items are composed of each of the five indicators: number facts skills, arithmetic skills, information skills, language skills, and visual skills.

For the qualitative part, the questionnaire consisted of two (2) general questions, viz:

1. What difficulties did you face in understanding mathematical concepts?
2. How did you cope with these difficulties in understanding mathematical concepts?

### Data Gathering

#### Survey

The researchers used a paper-and-pencil test to determine the level of difficulty of the students in understanding mathematical concepts. The conveniently sampled respondents were approached in their classrooms during their mathematics classes. They were asked to fill out a form with the guidance of the researchers. In total, the survey lasted for about 30 minutes. The responses were then tallied and consolidated in preparation for analysis.

### Qualitative Inquiry

A qualitative inquiry followed after the quantitative survey. Seven students participated in the Key Informant Interviews (KIIs). The KIIs focused on the student's difficulties and coping strategies in mathematics learning. A different set of seven students also participated in one session of Focus Group Discussion (FGD), where questions about their challenges and coping strategies in understanding mathematical concepts were asked. The researchers audio-recorded the entire conversation. The researchers audio-recorded the conversations with the consent of the participants.

### Data Analysis

#### Descriptive Statistics

Descriptive statistics using mean was employed in determining the respondent's difficulty level in understanding mathematical concepts in each indicator. The result was analyzed based on the formulated parameter limits and their descriptive equivalents.

#### Simple Thematic Analysis

The researchers used simple thematic analysis to analyze the responses of the participants. The participants' answers were recorded and transcribed verbatim. The researchers then analyzed to identify different codes, which were words or phrases that were repeated in the participants' responses relevant to the study's problem (i.e., the challenges students face

in understanding Mathematical concepts). The codes were grouped based on common themes that emerged from the data.

### **Ethical Considerations**

The researchers ensured that the participants were informed of the nature and purpose of the study by circulating informative papers. The participants were

not forced to obtain information from them. They were also given informative consent forms assuring them that their declination would not affect their grades. Furthermore, the participants were assured that personal data will not be disclosed to the public pursuant to the revisions of RA 10173 or the Data Privacy Act of 2012. In case of publication of the results, their identities shall remain unknown for their privacy and protection.

## **RESULTS AND DISCUSSION**

### **Level of Difficulties**

The data presented in Table 2 shows the level of difficulty in understanding the Mathematical concepts among the students. Data included the mean in five indicators,

specifically number facts, arithmetic skills, information skills, language skills, and visual skills. It is shown that the overall mean is 1.60, with a very high descriptive equivalent.

**Table 2.** Level of difficulties in solving word problems.

<b>Indicator</b>	<b>Mean</b>	<b>SD</b>	<b>Descriptive Equivalent</b>
Number Facts	1.60	1.175	Very High
Arithmetic Skills	1.51	1.540	Very High
Information Skills	1.87	1.909	Very High
Language Skills	2.12	1.799	Very High
Visual Skills	0.93	1.344	Very High
<b>Total</b>	<b>1.60</b>	<b>1.109</b>	

Visual skills attained the lowest mean, 0.93, with a descriptive equivalent of very high. This means that among the five indicators, students found visual-spatial skills, the skill to visualize mathematical concepts and manipulate geometrical shapes and space meaningfully, very difficult than the others. Arithmetic skill, which includes accuracy and logarithm in the computational and mathematical working procedure, came next with a mean of 1.51. The mean is under the parameter limit with a descriptive equivalence of very high. The students also revealed high levels of difficulty in other indicators, including number facts ( $x=1.60$ ), information skills ( $x=1.87$ ), and language skills ( $x=2.12$ ). The five indicators attained a total mean of 1.60 under the parameter limit with a descriptive level of very high. This means that the level of difficulty in understanding

mathematical concepts among students who took the paper-and-pencil test is very difficult.

Among the five indicators, students tend to experience the most difficulty in visual-spatial skill, which is the skill to visualize mathematical concepts and manipulate geometrical shape and space meaningfully and are followed by arithmetic skill, which includes accuracy and logarithm in computational and mathematical working-procedure. The result implies that the intervention program should focus more on topics that can help the students improve their knowledge and skills in visualizing mathematical concepts, manipulating the geometrical shape and space meaningfully, accuracy and logarithm in the computational and mathematical working procedures, and proficiency in number facts, tables, and

mathematics principle, expertise to connect the information to a concept, operational, and experience as well the expertise to transfer information and transform problems into a mathematical sentence, the proficiency of terms and relevance of mathematical information and other relevant topics. The intervention program should also emphasize the five indicators because their descriptive levels are very difficult.

In connection with the findings, the importance of counting has been widely demonstrated. It is equally widely accepted that children need to gradually move beyond counting procedures if they are to perform addition and subtraction effectively in primary school (Cheng, 2012; Kullberg et al., 2020). It is also shown that pupils at this level are perfectly capable of developing these skills and that this has a very positive impact on their understanding of the relations between numbers (Björklund et al., 2019; Cheng, 2012; Tsamir et al., 2015). In addition, in the study of Arum et al. (2017), students have difficulties understanding the problem, choosing and using appropriate strategies for solving the problem, and students have difficulties with the computational process of solving a problem. Moreover, the findings are also supported by Haryanti et al. (2019), wherein they stated that most of the students made mistakes in transforming the word problem into a mathematics model, both formulas or illustrations with pictures.

## Challenges

### Analyzing the Problem

A poorly defined problem is more difficult to solve than a problem you have clearly defined and analyzed. The way a problem is worded and understood has a huge impact on the number, quality, and type of proposed solutions.

*“First of all, understanding mathematical concepts is very hard, especially in dealing with different concepts and theories. There are theories, especially formulas nga lisod jud siya sabton kay kailangan pa nimo e trace back and then especially sa inyong gihatag na answeran which is about*

*geometry. Lisod jud siya kayo jud.”* (First of all, understanding mathematical concepts is very hard, especially in dealing with different concepts and theories. Some theories and formulas are difficult to understand. You must trace back the given answers in geometry. It is very complex.) Participant 4.

*“Ako kay analyze the problem lisod jud kaayo ianalyze labaw nag complicated na kaayo kanang nag sabaysabay na ang mga kuan mga numbers unya wala ka kabalo kung asay ma gamit, asa ang di pwede gamiton. Ana lang siya.”* (For me, you have to analyze the problem because it is complicated for us when the numbers are in the same appearance it is confusing for us what are those things to use and not to use. That’s all.) Participant 3.

Difficulty in analyzing the problem is connected to the study of Reddy and Panacharoensawad (2017), which revealed that poor mathematical skills and a lack of understanding of the problem are the major obstacles in the domain of problem-solving skills. This proves to be one of the reasons why overall achievement in mathematics is considered quite low. It also reflects that students have difficulties in comprehending mathematical problems affecting the process of problem-solving and mathematical concepts.

### Understanding the Concept

Knowing a mathematics concept means knowing the solutions behind the answer. There is a need to understand the answer obtained without the need to memorize specific answers or formulas.

One of the problems is visualizing the problem, especially word problems, and interpreting an equation. Participant 3.

The way you comprehend the given mathematical concepts or the way you perceive the problem. Participant 6.

Warger (2018) positioned that visualization facilitates comprehension, memory and recall, and problem-solving.

It is a critical component of problem representation, yet many students do not use this important process in learning. To add, it is a common misconception about the memory problems of these students that it is an information storage problem, which, somehow, these students just never get stored properly.

### **Identifying the Correct Solution**

Identifying the correct solution pertains to finding the most appropriate approach or methodology to solve a particular mathematics problem. It involves determining the right set of steps or formulas to follow that will lead to the correct answer or result.

*“Identifying. identifying sa figure kung tama ba siya or naa man guy usahay na malipat ka. Ana lang or tama ba ang pag sabot.”* (Identifying the figure if it is correct or if some instances are obscure. That is all, or I don’t know if that is correct.) Participant 2.

*“Ang kanang mag ano kag solution kung asa ka mag construct mag sugod ug unsaon nimo siya pag end.”* (It needs to form a solution in constructing at the beginning and how to end.) Participant 3.

The respondents of Simatupang et al. (2019) were not able to identify the correct solution because of the inability to associate information with one another. Acquiring a proper understanding of concepts initially aids in memory retrieval during exams, yet if the retention of essential information poses a challenge, alternative study methods may be necessary.

### **Establishing the Equation**

Establishing the equation pertains to creating an equation based on the given problem and creating equality containing one or more variables. Solving the equation consists of determining which values of the variables make the equality true.

*“Kanang magbuhat kag equation, pag huna-huna og pagbuhat sa number into words.”* (Creating an equation, visualizing,

then translating numbers into words.) Participant 7.

*“Kuan pag create ug equation sa isa ka problem kung unsa imong gamiton para ma solve nimo tanan problem.”* (In creating an equation to a problem, what will be going to use that will solve all the problems.) Participant 5.

Based on the results of the study by Utami et al. (2019), it is known that most students still have low mathematical representation ability. Students find it difficult to understand problems and write equations correctly. This is because students are not used to solving problems in the form of visual, verbal, and symbolic representations.

### **Simplifying the Expression**

When an algebraic expression is simplified, an equivalent expression is found that is simpler than the original. This usually means that the simplified expression is shorter than the original.

*“Mga ano mga theorems sa example sa geometry ang trigonometry theorem then sa algebra mga simplifying of ano ug mga expressions.”* (Those theorems are examples of geometry, the trigonometry theorem in algebra, those are simplifying of expressions.) Participant 2.

*“Problem-solving because you need to comprehend it more. analyze it more.”* (Problem-solving because you need to comprehend it more and at the same time analyze.) Participant 6.

Many students have difficulties with basic algebraic concepts, especially in simplifying expressions in high school and at university. In addition, students have difficulties visualizing algebraic forms and applying the associativity and distributive properties of algebraic expressions when they factorize or simplify algebraic terms (Muchoko et al., 2019).

### **Familiarizing the Formula**

Familiarizing with the formula in mathematics requires both understanding

the underlying concepts and memorizing the formula to solve problems effectively and efficiently.

*“Kuan sometimes kay ano man gud kay usahay naa man gud tay murag kanang feeling nato mao na siya nga formula ang kuan pero mali diay siya . Oh ana.”* (Sometimes, there are times that you are sure with your formula but when you check you find out that it is not right.) Participant 2.

*“Maybe, libog man gud ko usahay kung unsa nga formula ang gamiton.”* It may be confusing what formula that will be going to use. Participant 3.

*“Yes naman kay importante jud ang formula kay og dili ta kabalo sa formula dili ta ka answer sa question nga gihatag sa atong teacher.”* (Yes, of course, because formulas matter a lot; if we don't know the formula, then we cannot be able to answer the exercises given by the teacher.) Participant 4.

Based on the study of Hoque (2018), memorization should not be ignored at all. It is that memorizing things is as important for exercising the brain as physical activity is important for exercising the body.

### **Coping Strategies**

This explains how students faced difficulties in understanding mathematical concepts. The major themes in this area were self-perseverance, expert consultation, reading and studying, constant practice, and confidence building. This means that the students have strategies for understanding mathematical concepts because they tend to challenge themselves to overcome this problem.

### **Self-Perseverance**

The participants self-persevere despite the difficulties in understanding mathematical concepts. For them, it is one of the best ways to cope with the challenges, especially since they need to pass their mathematics courses to obtain their degrees. They recognized that their anxieties and hardships would be addressed with the right attitude to succeed in their studies.

*“Syempre makulbaan then maratol kay di pud makakuan ka ba nga kuan nga basig dili ka answer tungod sa kanang kalisod sa problem.”* (You can feel anxious because what if you cannot answer or maybe you cannot answer the problem.) Participant 3.

*“I sometimes feel afraid because it is so hard if we cannot be able to understand some formulas, especially in solving the problems.”* (I feel fear sometimes because it is hard for me if we cannot be able to understand some formulas, especially in solving problems.) Participant 4.

Yang et al. (2021) reported that mathematical understanding could be achieved when new concepts are connected to at least two existing concepts within a student's cognitive structure. To help students fully understand new mathematical concepts, teachers should first explain the definition of a given concept to students and, subsequently, teach them how to create a specific example based on examples of an existing concept.

### **Expert Consultation**

Asking experts or individuals with a deep understanding of mathematics can enhance the problem-solving skills of the students, improve their understanding of mathematical concepts, and boost confidence when dealing with mathematical problems.

*“Ano? I just trust my answer whatever happens and kanang dili na jud nako kaya, patudlo na lang ko sa experts.”* (I just trust my answer whatever happens, and if I cannot do it by myself, then I will look for someone to help me.) Participant 1.

*“Do not stick to the single formula; find another way na maka solve mga problems na related lang sa mathematical sa old na concepts.”* (Do not stick to a single formula, find another that you can easily solve problems which are related to mathematics in old concepts.) Participant 2.

*“Through research at the same time by asking my friends and classmates about how to solve those problems and how to get the*

*formulas or deriving formulas.*” (Through research at the same time by asking my friends and classmates about how to solve those problems and how to get the formulas or derive formulas.) Participant 4.

Ayuwanti et al. (2021) documented that one of the first things to recommend to anyone is to find an expert. Teacher-student interaction in mathematics learning can help students build and improve mathematical understanding.

### **Reading and Studying**

Students need to have a good analysis of the different concepts as it assists in their ability to follow instructions and solve problems.

*“Iano jud first kay kato pag basa sa basahon nako ang theory if naa siyay mga clarification or mga kanang pag ano pag dili jud nako siya ma analyze ug tarung ano , balik balik lang gihapun nakog basa ang theory problem or theoretical problem.”* (First is when I read the theory, if there is any clarification or if I cannot be able to analyze the problem, then I will read it again and again until I can answer the theoretical problem.) Participant 1.

*“Analyze the problem, read and read the concepts para maapply pa to the ano near perfect ang pag apply sa mathematical problems.”* (Analyze the problem, read and read the concepts so that you can apply them near to perfection when you apply them in mathematical problems.) Participant 2.

According to Laily (2018), reading comprehension is considered one of the prominent skills for learners. With this, students are required to catch some implied and stated information from the text by interpreting or analyzing the sentences to solve the problems.

### **Constant Practice**

Practice is the act of rehearsing behavior repeatedly or engaging in an activity again. Constant and proper practice makes it better.

*“Kuanon lang... pangitaan nako ug paagi para ma solve ug maayo.”* (You have to find any ways of operating in able to solve it.) Participant 3.

*“Ahh. How? Kuan siguro. Para sa akoo pag solve ang difficulties sa problem trial ang error . the let x in variable para Makita jud kung unsa ang problem na gipangita.”* (Maybe for me, in solving difficult problems, trial and error. The “let x” in variable so that you can see what the problem is being found.) Participant 5.

*“By practicing solving, practice lang jud.”* (By practicing solving problems. Just practice.) Participant 1.

Constant exposure to practice papers led to a positive trajectory, which inculcated a desirable attitude toward mathematics. In addition, Kibe and Mawira’s (2020) study showed that if the students practice solving it will improve their mathematics skills.

### **Confidence Building**

Immersion in mathematics can help to increase students’ comfort and confidence with the subject, enhance problem-solving skills, and foster a deeper appreciation for its importance in daily life.

*“Ahh. Nangita kog paraan para ma improve nako akoang weakness”* (I will find ways to improve my weakness.) Participant 3.

*“I simply work on my own. If more time, I am doing much of my time researching and then solving some problems to help me understand the given questions.”* (I simply work on my own, if I have more time I’ll spend it on research and then solving some math problems that help me to understand the given questions.) Participant 4.

*“Same with it. I do some activities that could help me in solving those difficulties that I had able to face during the solution or solving all the problems”* (Same with, I do some activities that could help me in solving those difficult math problems so that I can show some solution to the said problem.) Participant 4.



Furthermore, according to Moneva and Valle (2020) students have to trust and believe that they can tackle mathematical problems and shall overcome their fear and inhibitions. Self-confidence is one of the essential qualities that students should possess because it helps them lessen their difficulty in mathematics.

## CONCLUSION

Based on the findings of this investigation, the level of difficulty in understanding mathematical concepts among the students is very high. The most common difficulties that students encounter in understanding mathematical concepts are analyzing the problem, understanding the concept, identifying the correct solution, establishing the equation, and simplifying the expression. In addition, the difficulties that the students faced in understanding mathematical concepts were self-perseverance, expert consultation, reading and studying, constant practice, and confidence building. On the bases of the aforementioned findings of the study and drawn conclusions, it was recommended that teachers might impart to the students the procedures to understand the problems and assimilate real-world problems in solving word problems so that the students would see the significance of solving in their daily lives, it may be an incorporation of fun and entertaining factor in understanding the problems, free and open communication between the teachers and the students so that the students can ask things that are not yet clear to them.

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