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Math Anxiety and Mathematical Representations of Grade 7 Students

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Abstract

Naturally, students are afraid to learn Mathematics that progresses as a fear of getting things wrong. This study utilizes the descriptive-correlational research design to test how the math anxiety and mathematics are connected to each other. Forty-two (42) Grade 7 students participated in the study during the school year 2020-2021. It used a researcher-made survey questionnaire on math anxiety and an examination on mathematical representations through modular learning. The math anxiety is indicated by mathematics test anxiety and numerical anxiety both with ten statements. Meanwhile, the examination was focused on the different components of mathematical representation such as pictures, manipulative models, written symbols, real-world situations and oral language. The result showed that students have high level of anxiety towards mathematics. Although students experience high level of test and numerical anxiety, their mathematical representations examination showed 'developing' level of performance. These two inverse results were supported by a no significant relationship between the math anxiety and students' performance in mathematics. Although the inverse relationship proved the effect of the anxiety on the test scores, the null hypothesis on the relationship of the variables was rejected. The study recommends further testing involving different modalities of learning such as online and hybrid.

Keywords: *Grade 7 Students, Math Anxiety, Mathematical Representations, Representations*

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1. Introduction

Mathematics can improve students' understanding through solving problems, logical reasoning and critical thinking skills. According to Sullivan (2013), mathematics formalizes some of the innate ideas about mathematical objects, develops the ability to make and write good proofs, improves problem-solving skills and aptitude to use mathematical knowledge and cultivates an appreciation for art and science of mathematics. While few enjoy the critical thinking in mathematics, majority fear the subject and its concept alone. The fear of mathematics is known as math anxiety. It affects many people in a passive behavior that can be distressing. As stated by Ziegler and Loos (2017), mathematics would not motivate students at school to do math, they cannot consider mathematics as a possible career choice. Furthermore, math anxiety may be a crucial factor which may determine the level of mathematics performance among high school students, to minimize the anxiety level and its attributes to commend their performance in mathematics (Jolejole-Caube et al., 2020).

That being said, math anxiety could affect students' working memory that might disrupt students such as their peers, struggles, and their study habits. Moreover, teachers who experience math anxiety has the tendency to transfer it to students (Ramirez et al., 2018). It causes negative behavior due to the fear being felt while working on numbers or solving word problems in the subject. Students could overcome the math anxiety if they could manage their stress and behavior by improving the basic mathematical skills that would help students to develop their performance in the class (Ruff & Boes, 2014).

According to Guita and Tan (2018), the learners who suffer from math anxiety may not be manifested in other disciplines. As a result, it is proven that students' anxiety is inversely linked to their mathematical success, because pupils who are fearful of circumstances, tension, and uneasiness associated with arithmetic may reflect anxiety in other disciplines. Given these premises, this study aims to evaluate the Grade 7 students' level of math anxiety and their performance in the mathematical representations. The mathematical anxiety is specifically focused on test anxiety and numerical anxiety while mathematical representations include pictures, manipulative models, written symbols, real-world situations and oral language. To refute previous studies linking students' anxiety to mathematical success, this study aims to prove the following hypothesis:

Ho1: There is no significant relationship between math anxiety and mathematical representations of Grade 7 students.

2. Literature Review

2.1 Math Anxiety

Laguen (2020), citing the results of the 2019 Trends in International Mathematics and Science Study, mentioned that Filipino Grade 4 students ranked bottom among 58 countries involved in the study, scoring 297 and 249 in Mathematics and Science, respectively. Filipinos ranking bottom is also true for the results in the Program for International Student Assessment (PISA) of the Organization for Economic Cooperation and Development (OECD). The poor performance in mathematics is normally linked to students' dislike of the subject (Khasawneh et al., 2021; Carey et al., 2016; Caviola et al., 2022; Essuman et al., 2021).

Math anxiety designates the deleterious actions of the students that assumes elicit tough reactions and the uneasiness of the attitude towards mathematics than the academic subjects (Downer et al., 2016). It reacts as the opposed mood that might affect the success and the future career of the students in the subject (Dagaylo-An & Tancinco, 2016). It states the feelings towards the subject that deals with the aspect of an individual. According to Seng (2015), the two categories of math anxiety include mathematics test anxiety and numerical anxiety. Test anxiety is described as 'I can't syndrome,' a feeling of uncertainty" (Gresham, 2007, p. 181) and internal pressure within students that they have not grasped the concept (Cavanagh, 2007). On the other hand, numerical anxiety occurs when undertaking math operations and manipulating numbers (Luttenberger et al., 2018; Kazelskis, 1998; Baloglu, 2007).

In the Philippines, math anxiety is normal to some students, but it could happen to every student at any age. Most of the students are afraid to learn math because of the following reasons: lack of motivation, failure in examinations, terror teachers, instant gratification, learned helplessness, the denigration of deep thought in the society and the neglectful of pressure-inducing parents (Lee-Chua, 2012). Futalan and Mamhot (2018) found that math anxiety of students increases from the lower grade levels to upper grade levels. Nevertheless, students with math anxiety still rise when students are confronted with subject matters that are innovative and come in loose. Students' increased anxiety when it comes to mathematics learning has been linked to an overburdened content of the curriculum and the additional courses or subjects that were not sufficiently framed in a pre-spiraled form.

According to Ramirez et al. (2018), there are ways to identify where math anxiety comes from. For instance, the student's reflection involves self-report questionnaires that would ask them to tell how they feel in the subject, the situations and the environment in the class. As Math Anxiety continues, things would not be cleared enough to improve their performance and it might affect student's big impact on them. It is mentioned that most people are vulnerable to the effects of math anxiety for the reason that the demographic factors still exist in the scale of the math anxiety and mathematical achievement.

2.2 Mathematical Representations

The basic manner in which students may comprehend concepts and problems in Mathematics is through proper mathematical representation. Since in most constructs, representation is provided by using a sign or a configuration of signs, elements through texts, or objects to symbolize, characterize, or depict something to properly represent, students use representations to support their comprehension by dealing with abstract ideas into specific ideas using logical thinking. Mathematical representations were efficiently used to clarify word problems and fractions, the use of visual representations and develop the conceptual understanding of the students (Widakdo, 2017).

Mathematical representations are one of the significant standards of learning to develop the students thinking and analyzing skills that processes the construction and abstraction of mathematical ideas of the students (Rahmawati et al., 2017). The purpose of mathematical representations is to get the idea of the student's capability of expressing mathematical concepts and apply the problems in real life (Siregar, 2019). The importance of mathematical representations is to grow the skill of students in conceptual understanding (Jitendra et al., 2016). Building connections between different representations is crucial to produce conceptual understanding. Due to the fact that students could struggle from presenting the tasks given, it might cause them to overthink about what students think about the task (Smith et al., 2018).

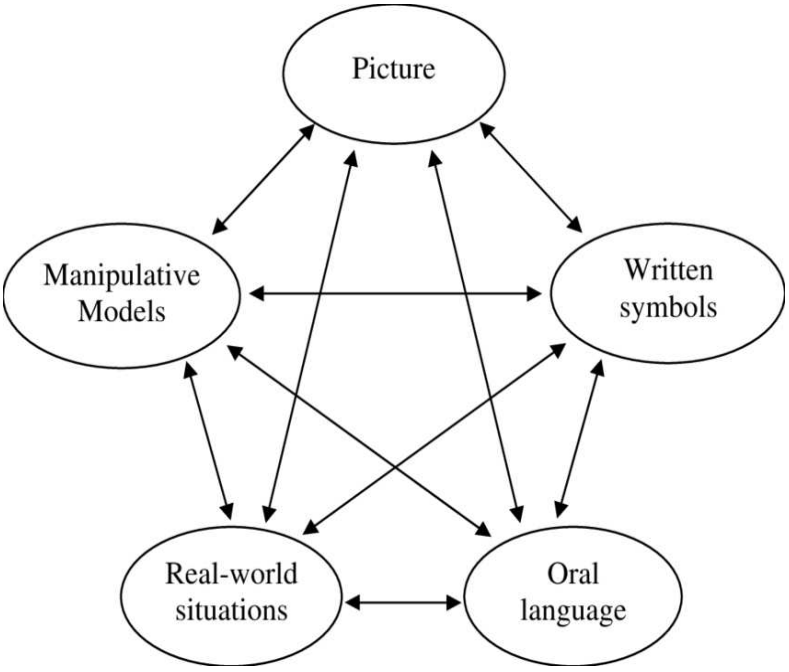
According to Widada et al. (2018), the augmentation of mathematical representations could implement the process of mathematical communication in oral and writing skills. Learning mathematics could be more memorable if the ability was taught in the meaningful manner. For instance, Trance et al. (2012) explored the visual representations of the students alongside mathematics to transform the educational curricula of learning from teacher-centered to learner-centered that utilizes the games and the learner's imagination to develop the student's interest within the traditional learning methods of mathematical representations. Similarly, Rahmawati et

al. (2017) used mathematical representation through images, tables, graphs, verbal representation, numerical and algebra. As such, tt is important to translate mathematical representations for articulating mathematical concepts.

According to Van De Walle (2004) and Chen and Wu (2004), mathematical representation acts as the mathematical concept or relationship that forms into the ideas that are tangible. Students have the ability to create and represent their mathematical ideas to organize, record, select, apply and translate these mathematical representations to solve word problems. When students develop flexibility with a lot of diverse representations for mathematical ideas, it might obtain a skill to apply into new areas and add their own understanding to communicate ideas with other students.

Figure 1

The Modes of Mathematical Representations



Source: Van De Walle (2004)

Figure 1 shows the modes of mathematical representations. This shows the connection of the modes that produce the performance of each student. It also conceptualizes the manipulative models that involves mathematical concepts that could be more attractive, durable and simplistic. Pictures help students to engage their critical thinking and imagination. Written symbols utilize

the value of using mathematical operations, Real-world situations applies the students' daily life basis and oral language that would help them to communicate mathematically.

3. Methodology

Descriptive-correlational research design was utilized in this study. As expounded by Baker (2017), in this design there are two variables which are tested for relationship. The participants of the study were 42 Grade 7 Students of an integrated high school in San Pablo, Laguna, Philippines. These students are in one group duly enrolled during the school year 2020 – 2021 consisting of 18 males and 24 females. All the students in the class were included as study participants.

There are two data gathering instruments used in the study: survey questionnaire and test. The researcher-made survey consists of two sections that assessed the test anxiety and numerical anxiety of the participants. There were ten (10) questions for each section. On the other hand, the examination tested the students' knowledge on mathematical concepts. It is focused on picture, written symbols, oral language, real-world situations and manipulative models. The survey questionnaire was tested for internal consistency using Cronbach Alpha as shown in table 1.

Table 1.
Cronbach's Alpha Result

Subscale	No. of Items	Cronbach's Alpha	Internal Consistency
Math Anxiety			
Mathematics Test Anxiety	10	.939	Excellent
Numerical Anxiety	10	.943	Excellent

During the first week of the class, the module on modes of mathematical representation was given to the students as their preparation guide for the assessment. After two (2) weeks, a printed copy of the questionnaire and examination were given to each student. After another two (2) weeks, the answered survey questionnaire and examination were retrieved and tabulated.

To ascertain the math anxiety of the respondents based on the variables and descriptors in the study, mean and standard deviation were determined. In evaluating the result of students' examination in mathematical representations, frequency distribution was used. Lastly, to test whether there is significant relationship between math anxiety and mathematical representations, Pearson product-moment correlation was used.

4. Findings and Discussion

Table 2

The Students' Manifestation of Mathematics Test Anxiety

Statements Whenever I take Examinations in Mathematics…	Mean	SD	Verbal Interpretation
1. I feel nervous if the teacher gives feedback to my output, then I can no longer answer the questions in the next activity.	2.64	0.73	Agree
2. If I open module to review concepts, it felt like I'm finding it difficult to understand due to heavy concepts presented.	2.98	0.64	Agree
3. While I'm answering a test, I think about how badly I'm doing.	2.45	0.83	Disagree
4. Time affects my performance whenever I'm taking a test.	2.83	0.76	Agree
5. My feeling as I accomplish the test is that I have done badly.	2.60	0.70	Agree
6. I am afraid that I can't catch up with the rest of the class.	2.62	0.76	Agree
7. I have a feeling that we will have to take a Math Test in advance without any announcement.	2.74	0.77	Agree
8. I become tensed while preparing myself for a Math Test.	3.02	0.64	Agree
9. I may not do well in Math Tests.	2.74	0.89	Agree
10. My heart is beating fast during examinations.	2.90	0.79	Agree
Overall	**2.75**	**0.41**	**Agree**

Legend: 3.50 – 4.00 (Strongly Agree/Very High Level of Anxiety), 2.50 – 3.49 (Agree/High Level of Anxiety), 1.50 – 2.49 (Disagree/Low Level of Anxiety), 1.00 – 1.49 (Strongly Disagree/Controlled Level of Anxiety)

Table 2 shows the manifestation of the student-respondents towards mathematics test anxiety. It is stated that student-respondents agreed to all the indicators with the overall mean of 2.75, and standard deviation of 0.41. It signifies that most of the students have high level of math anxiety while anticipating a mathematics test in a modular setting. According to Oxford Learning (2017), students become worried as a result of the deadlines imposed by timed tests. As a result, people forget concepts that they don't have trouble recalling at home. The student's dread of failing is validated because these assessments can have a detrimental influence on marks. This can lead to a difficult-to-break vicious cycle. The results are same as the findings from Reyes and Castillo (2015) that mathematics test anxiety is a physiological condition which involves pressure and discomfort before, during and after taking the test. It connotes that student find it difficult to pass the Mathematics Test.

Table 3

The Perception of the Student-Respondents towards Numerical Anxiety

Statements Whenever I face Numerical Figures and Concepts…	Mean	SD	Verbal Interpretation
1. I feel frustrated to do mental arithmetic during class.	2.71	0.74	Agree
2. I'm hesitant to show my calculations for the solutions of the problem.	2.88	0.63	Agree
3. I was nervous given a set of numerical problems involving operations.	2.71	0.83	Disagree
4. I felt uneasy when I try my best to solve mathematical problems.	2.93	0.78	Agree
5. I discern myself that Mathematics seem like hard for me.	2.90	0.69	Agree
6. I just "freeze up" when I saw a math problem.	2.52	0.92	Agree
7. I was given a Math assignment with lots of numerical problems to answer.	2.60	0.70	Agree
8. I felt anxious when I think about numbers.	2.64	0.76	Agree
9. I'm concerned about my skills to solve mathematical problems.	2.98	0.72	Agree
10. I'm worried that I can't express my solutions and calculations in front of the class.	2.86	0.78	Agree
Overall	**2.77**	**0.43**	**Agree**

Legend: 3.50 – 4.00 (Strongly Agree/Very High Level of Anxiety), 2.50 – 3.49 (Agree/High Level of Anxiety), 1.50 – 2.49 (Disagree/Low Level of Anxiety), 1.00 – 1.49 (Strongly Disagree/Controlled Level of Anxiety)

It can be gleaned from table 3 that students agreed from the indicators provided with the overall mean of 2.77, and the standard deviation of 0.43. From the result it can be seen that students are frightened to perform calculations and solutions manifesting numerical anxiety in daily life situations and disrupts the performance of the individual.

Numerical anxiety are omnipresent from the perspective of a single individual of the student and the civilization as a whole. It also involves the mathematics in the real world and academic situations (Mitchell, 2018; Skagerlund et al., 2019). In the study of Dowker et al. (2016), numerical anxiety was given solution in the past years by enhancing students to focus on the mathematical performance to lessen the anxiety. Santos et al. (2015) recommended to utilize mathematical modeling that could have impact towards numerical anxiety.

Table 4

The Students' Performance in Mathematical Representations

Scores	F	%	Interpretation
		Pictures	
4	--	--	Excellent
3	6	14.30	Proficient
2	10	23.80	Developing
0-1	26	61.90	Beginner
		Manipulative Models	
7-8	4	9.50	Excellent
5-6	9	21.40	Proficient
3-4	6	14.30	Developing
0-2	23	54.80	Beginner
		Written Symbols	
2	17	40.50	Excellent
1	20	47.60	Proficient
0	5	11.90	Beginner
		Real-World Situations	
15-18	6	14.30	Excellent
10-14	27	64.30	Proficient
5-9	5	11.90	Developing
0-4	4	9.50	Beginner
		Oral Language	
7-8	4	9.50	Excellent
5-6	4	9.50	Proficient
3-4	13	31.00	Developing
0-2	21	50.00	Beginner

Table 4 shows the test performance of the students in mathematical representation.

In terms of pictures, most of the student-respondents are in the beginning level (61.9 percent). Essentially, it was observed that student-respondents have poor understanding of the concepts found in the examination. Meanwhile, some student-respondents (14.3 percent) are Proficient in analyzing pictures. Azizaa (2017) argued that pictures are fundamental in forming the thoughts of students with the use of their own imagination that growths the student's creativity and understanding via learning Mathematics in the Classroom.

In terms of manipulative models, students (54.8 percent) are also in the beginning level. Majority of the student-respondents failed to apply the manipulatives given in the examination. It is mediocre that student-respondents did not attempt to answer it or use the manipulatives appropriately, and refused to answer the questions. Although 9.5 percent of the student-respondents received "Excellent" in their total score, fewer student-respondents clearly used the

manipulatives prior to the given. Moreover, these students are those identified as students who excel in class. Meke et al. (2019) contended that manipulatives in mathematics intend to aid students to solve mathematical problems, utilize the tool, concrete abstract ideas and make the subject more interactive and fun that increases student's learning interest in the learning process to understand the concept in the given problem.

In terms of written symbols, students are predominantly (47.6 percent) proficient. This result can be interpreted that students merely understand the essence of solving equations and representing written symbols mathematically. On the other hand, few of the student-respondents (11.9 percent) were "beginners". Fundamentally, fewer student-respondents did not operate the values of performing mathematical operations that refers to the mathematical quantities given. Based on the study of Selvianiresa and Jupri (2017), the aptitude to attain the mathematical symbols was to develop the numeracy skills early to answer the symbols and equations easily. Also, teachers have to deliver the topic as well as students to understand the core of Roman Numerals in the daily life, as long as you could saw in the clock, books or novels, and the Bible. In relation to this, mathematical symbols could envisage the number sense that leads to strong efficient and perceive the student's performance. But it was not enough to reach the mathematical ability, it requires experience to develop the purpose of mathematical symbols in using number operations and equations (Hua et al., 2019).

In terms of real-world situations, students (64.3 percent) were also in the proficient level. It shows that, most likely, students can apply mathematical concepts to real-world situations. However, some student-respondents (9.5 percent) were in the "Beginning" level in Real-World Situations. Ojose (2011) mentioned that students shall apply real-world situations that is pertinent to their interest, either educational or professional.

Majority of the students (50 percent) were in the beginning level in oral language. It further denotes that student-respondents fail to develop mathematical thinking skills that could affect the way students communicate and explain their solutions to mathematical problems. In contrast, a few student-respondents (9.5 percent) were "proficient" and "excellent". These students are capable to answer the word problems given in the oral languages and accurately communicates solutions to the problems and the concepts given. As determined by Fuchs et al. (2018), oral language is one of the predictors that plays a role in solving word problems. Moreover, students are enabled to use the representation to interpret the physical, social and mathematical phenomena (Minarni et al., 2016).

Table 5

Relationship Between Math Anxiety and Mathematical Representations

Variables	Pictures	Manipulative Models	Written Symbols	Real- World Situations	Oral Language
Mathematics Test Anxiety	.024	.051	.129	-.023	.072
Numerical Anxiety	-.095	.149	.044	-.144	-.076

*Legend: **. Correlation is significant at the 0.01 level (2-tailed).*
**. Correlation is significant at the 0.05 level (2-tailed).*

Based on table 5, math anxiety does not significantly relate to mathematical representations of students by taking a math test and solving numerical concepts. Even though majority of the students have higher level of anxiety in mathematics, their performance in mathematical representations is in the developing level. The results further show negative or inverse relations for most of the variables. The result is congruent to the study of Sokolowski and Ansari (2017) that there is no proof that math anxiety of the students would affect their mathematical ability, Puteh and Khalin (2016) that no significant relationship between the level of math anxiety of the female and male students and Susilawati (2020) that there is no significant relationship between mathematical representations.

5. Conclusion

This study tested the relationship between the level of math anxiety and performance of the students in mathematical representations using descriptive-correlational design. The evaluation of the 42 Grade 7 students no significant relationship between the math anxiety and performance in mathematical representations. It signifies that most of the students are still aware of their own mathematics anxiety and fear of answering problems in mathematics but these do not greatly affect their abilities to answer the questions. Although the students' math anxiety level is relatively high, the test results showed developing performance in mathematical representations.

Due to the COVID-19 restrictions, individual mathematical skills of the students were not actually monitored in the modular distance learning modality. As such, it is recommended that further studies be conducted with other sets of students to verify the results. The study can also be replicated in different learning modalities such as online or hybrid to validate the outcomes of the current study.

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