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Influence of Math Anxiety on the Academic Performance of Grade 7 Students in Mathematics

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Abstract

Math anxiety has been a common feeling of students who learn Math. Exposure to this anxiety can have adverse effects to the students' performance. This research assessed the math anxiety and academic performance in Math of the Grade 7 students at a public national high school in Balamban, Cebu, Philippines. There were 80 respondents who participated in the study and were asked to answer a questionnaire that assessed their math anxiety while their performances in Math were determined using their average grade in Math for the First and Second Quarters. Data gathered were treated using descriptive and inferential statistics. Results revealed that the respondents had a fairly satisfactory performance in Math and experiencing moderate level of math anxiety. Math anxiety was found to have a significant negative correlation with the respondents' academic performance in Math. Thus, teachers are encouraged to help reduce the math anxiety of the students to improve their performance in the subject.

Keywords: math anxiety, academic performance in Math, Grade 7 students

Introduction

According to Organization for Economic Cooperation and Development (OECD) that a lot of students manifest little interest in Mathematics, poor perceptions of their math skills, and consider math as a difficult subject which result to their anxiety. Math anxiety is defined as a feeling of tension or fear that interferes with the manipulative and problem solving skills in a different situations of daily life and academic situations (Passolunghi et al., 2016). This feeling that is evident in most of the students is a product of cumulative negative experiences that students encounter in school from primary until high school as mathematical concepts are increasingly challenging (Beilock, Gunderson, Ramirez, & Levine, 2010; Geist, 2010). With these negative feelings that students develop towards the subject, their performance would be affected as they will try to avoid math related activities in school.

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Mathematics anxiety had shown to have affected in students in different countries and in all educational levels (Foley et al., 2017). Moreover, in the report of Programme for International Student Assessment (PISA) in 2012, a survey of the 64 participating countries on math anxiety revealed that 14.2% of the variance in students' mathematics performance is explained by the math anxiety experienced by students (OECD, 2013). This data proved that such issue on the life of the students must be given attention because this could harm the students' math performance. Prolonged exposure of the students to math anxiety will contribute to their negative attitudes towards the subject. Consequently, students will suffer the poor performance in the subject (Vitasari et al., 2010).

Philippines is among those countries which find students who experience math anxiety(Villavicencio & Bernardo, 2013). The effects of this fear of the students on the subject is reflected on the results of the Trends in International Mathematics and Science Study (TIMSS) in 2003 in which the country ranked 34th in math out of 38 participating countries. Furthermore, based on the 2016 – 2017 data, the country ranked 79th of 138 participating countries in the quality of math education according to the Global Competitiveness Report of the World Economic Forum.It cannot be discounted that students' attitudes on the subject could have affected their performance in these major assessments of the said institutions. Although there are other factors that could affect the students' performance, less have been explored on the math anxiety of the students that are linked to their academic performance in math.

It has been a consistent observation of the researchers that students of public national high schools manifest anxious feelings in their math classes. The prevalence of these feelings is more consistent on Grade 7 students. These feelings are manifested by the students on negative reactions to activities provided by the teacher to them. There is often less participation of the students in the class. Besides, when they are given tasks such as seat works and assignments, they are usually reluctant on accomplishing the tasks. There are strategies that teachers used to reinforce their enthusiasm towards learning the subject however it seems these strategies are not enough to bolster their likelihood to embrace the subject. There could be other factors that may affect the feelings of the students but the anxiety level of the students need to be assessed and how could it affect their performance in math. This plausible factor that could contribute to the performance of the students in Math is less explored by researchers in the Philippines. Hence, this study is conducted to determine the relationship of the math anxiety and academic performance of the Grade 7 students at a public national high school in Balamban, Cebu, Philippines. The findings of this study will contribute to the existing literature which will help the students manage the anxiety that they experience in learning math and minimize these experiences in learning the subject.

Review of Literature and Studies

This study is anchored on the three theories proposed by Carey et al. (2016) such as the Deficit theory, Reciprocal Theory and Debilitating Anxiety Model. The Deficit Theory suggests that individuals who experience poor performance in math will have the tendency to develop math anxiety. In so many cases, students who experience low grades because they encounter difficulties in learning math develop this kind of anxiety. They will have the fear of having the same performance in the subject because they feel that they are not capable of achieving in the

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subject. Most of these students have difficulty in numeric processing in their early age. Thus, an accumulation of these difficulties as the subject becomes more complicated will result to the development of math anxiety.

Moreover, the Reciprocal Theory suggests that higher anxiety contributes to the low performance of the individuals in math and vice versa. In connection to Deficit theory, this theory is established on the premise that the anxiety of individuals are brought about by the poor performance they experience in math. On the other hand, the feeling of anxiousness on individuals can contribute to their low performance in math. Alhough it was not established well by the proponents that this is true in all cases but several studies have supported this theory. Thus, the relationship between these two variables is considered bidirectional (Sharma, 2017).

TheDebilitating Anxiety Model suggests that the association between math anxiety and performance is determined by the negative effects of anxiety on learning and developing math skills.When students feel the anxiety in math, they will have the tendency to avoid this subject. Whenever there are activities related to this subject, students try to avoid being involved in these activities. As a result, their skills in the subject will not be develop as expected because of this avoidance. As the teacher gives assessment on their math skills, they are expected to perform low to the skills that they are trying to avoid. Hence, their performance in the subject will be relatively low. This task – avoidant behaviors contribute to the low performance of the students (Hirvonen et al., 2012). If this cannot be avoided, students will suffer the effects of anxiety towards their performance. Thus, it is imperative that students' anxiety level is assessed in order to provide idea on the educators on the specific effects of these feelings of the students towards their performance. With these, concerns regarding this subject that causes the children to feel the anxiety can be addressed by the right persons.

It is the duty of educators to lessen the burden of the students in school to avoid negative effects of such burdens on their academic performance. Students who are exposed to high anxiety will more likely develop negative attitudes towards learning. Consequently, these attitudes will have immediate effects to their performance. Worst thing that could happen would be their failure on the subjects. But it is mandated by the "No Filipino Child Left Behind Act of 2010" which states that the "state should protect and promote the right of the citizens to quality education and to take appropriate steps to make such education accessible to all".These laws ensure the protection of students in school. Thus, teachers need to have thorough understanding on the situations of the students in school in order not to add burden on them. In most literatures, students often feel anxious in math. It cannot be denied that most students find this subject difficult to learn. That is why they usually develop math anxiety as they move to the next level wherein the concepts are more complex. This study explore on the role of math anxiety on the performance of the students in math.

Literatures and related studies that would help build the framework of this study are discussed to provide more information that in course of the study.

Math anxiety is defined as a feeling of tension or fear that interferes with the manipulative and problem solving skills in a different situations of daily life and academic situations (Passolunghi et al., 2016).Passolunghi (2011) noted that many children experience difficulties in math even when they are still in primary school which resulted to the development

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of fear and less motivation of the children in their next grade levels. Maloney, Ansari, and Fugelsang (2011) found that more evidences show that simple mathematical skills such as counting and magnitude judgement cause anxiety to adults which suggests that this anxiety started in the early numerical abilities of individuals. If numerical skills are not mastered, these would cause difficulties in more complex math skills on individuals. Shaikh (2013) enumerated reasons why students experienced mathematical learning difficulties. He categorized six levels of math performance and four types of anxiety that individuals experience in math. Moreover, he found that students perceived mathematics as a difficult subject.As a consequence to these difficulties, they try to avoid math – related tasks. Moreover, the motivation of the students to improve their math skills is dependent on the comfort level that they experience while learning these skills (Ramirez, Chang, Maloney, Levine, & Beilock, 2016).

According to Rameli et al. (2014) that math anxiety will result to avoiding math – related tasks, solving math problems and choosing math – related courses. These behaviors of students will result to a poor performance in math. Wang et al. (2015) noted a negative relationship between math anxiety and math performance among students in their study. In an analysis conducted by Stankov, Lee, Luo, and Hogan (2012), they found that math anxiety is a significant predictor of math performance. Moreover, low performance is evident on the students and manifested by poor physical conditions like drowsiness, headache and dizziness whenever teachers discuss lessons in math. Most students who experience math anxiety have low confidence in their math ability and tend to take little number of required math courses in college which limits their career choice options (Garry, as cited in Mahigir, Venkatesh & Karimi 2012). Vukovic et al. (2013) found that math difficulties are not observed only on children with specific math learning disorders but also on children with emotional issues like math anxiety.

In the study of Devine et al. (2013) on the 433 junior high school students which assessed their level of math anxiety and mathematics performance, they found out that there was no significant difference on the math anxiety and performance of the students based on gender. Female students had higher math anxiety compared to the male students. Furthermore, there was a positive correlation between math anxiety and test anxiety but a negative correlation between math anxiety and their performance. Notably, math anxiety was a significant predictor of math performance among female students. Their findings were consistent with the findings of Cheema and Galluzzo (2013) who reported that female students had higher anxiety in dealing with their math subjects.

Likewise, Venkatesan and Karimi (2010) investigated the level of anxiety and math performance among the 424 students from 12 high schools in India. They found no significant gender difference on math anxiety and math performance of the students. However, female students had higher level of math anxiety. The results in the study of Luo et al. (2009) on 311 high school students at a university in China also revealed that female students had higher level of math anxiety but they scored higher in math compared to their counterparts. They compared the anxiety level across grade levels which showed that the Grade 7 students had the lowest anxiety level while the Grade 9 students had the highest level of anxiety however the differences on the anxiety level were not significant. Thus, they concluded that there was an indication that anxiety level increases as the grade level increases.

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Justicia – Galiano et al. (2017) investigated working memory and math self – concept on their role as possible mediators which could possibly explain the relationship between math anxiety and math achievement of the 167 children aging from 8 – 12 years old who participated in the study. Results revealed that the two mediators contributed in explaining the relationship of math anxiety and math achievement. Thus, they suggested that these two mediators would be considered in creating interventions that will help students manage their math anxiety.

Estonanto (2017) investigated the relationship between math anxiety and academic performance in Pre – Calculus of the 88 senior high school students from the Laboratory High School in Sorsogon State College. Results showed that 77% percent of the respondents experienced math anxiety while 41 % of them had low academic performance. Moreover, there was a negative relationship between math anxiety and the performance of the students in Pre – Calculus.

In the study conducted by Nipaz, Belecina and Garvida (2016) which aimed to determine the effects of language of encouragement and praise on mathematics anxiety, self-efficacy, and mathematics performance of college students in the Philippines. The study used a comparison group design to test the effects of language of encouragement on math anxiety, self – efficacy and math performance of the students. Results showed that this technique had adaptive effects in which encouragement reduced math anxiety, improve self – efficacy and increase math performance better than the use of praises. Furthermore, math anxiety and self – efficacy had a significant negative correlation while self – efficacy and math performance had a positive correlation. However, there was no significant correlation between math anxiety and math performance of the students.

It is on these literatures and studies that this study is anchored on to explore the math anxiety and math performance of the Grade 7 students at this public national high school. The interplay of these variables are assessed on this group of students that seemed to experience math anxiety as observed by their teachers.

Methodology

This study employed the descriptive correlational research design which determined the relationship between math anxiety and the academic performance of the Grade 7 students. Correlational research is searching for variables that possibly have interaction with each other so that when this interaction exists one can say that if one of these variables changes it can be concluded that the other variable also change (Correlational Research: Definition, Purpose & Examples, 2013). Simple random sampling was used to identify the 80 respondents which is composed of 43 female and 37 male students while the Slovin's formula was utilized to determine the sample size. Slovin's formula is used to determine the sample size when one does not know the about the behavior of the population (Glen, 2021). Respondents' math anxiety was assessed using a survey questionnaire adapted from the Abbreviated Mathematics Anxiety Rating Scale (A – MARS) by Alexander and Martray (1989) which has 25 items describing the anxiety of students in learning Math. Respondents were asked to rate each statement based on their perceived anxiety in learning Math using a five – point Likert scale with the corresponding

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verbal description namely: 5 – Very High, 4 – High, 3 – Moderate, 2 – Low and 1 – Very Low. Furthermore, the performances of the respondents in Math were assessed using the average of their First to Second Quarter Grades with the assistance of their adviser.

Findings

This part illustrates the level of academic performance of the respondents in Math, their level of Math anxiety and the test on the relationship of these variables. The performance of the respondents in Math were assessed using their average grade during the First and Second Quarters which was classified in accordance to the Department of Education Order no.58 series 2017 as presented in Table 1.

Table 1. Performance level of the respondents in Math

Performance Level	Numerical Rating	f	%
Outstanding	90 – 100	15	18.75
Very Satisfactory	85 – 89	16	20.00
Satisfactory	80 – 84	19	23.75
Fairly Satisfactory	75 – 79	26	32.50
Did not meet the Expectations	Below 75	4	5.00
Total		***80***	***100.00***
Average		***82.6***	

As shown in Table 1, out of the 80 respondents, there were 26 or 32.50 percent of them who had fairly satisfactory performance in the subject. There were 19 or 23.75 percent of them who had satisfactory performance and 16 or 20.00 percent of them had very satisfactory performance. Interestingly, there were 15 or 18.75 percent of them who had outstanding performance in the subject. However, there were four or 5.00 percent of them who did not meet the expectations. This means that they failed in the subject. The data implies that the performance of the respondents in Math needs to be improved especially that there are respondents who failed in the subject for the two quarters. Aside from that, most of them had fair performance which implies that they have difficulties in the subject. When students, experience difficulties in a subject, they will have the chances of developing anxiety towards the subject. Thus, it is important that they are given reinforcement in order to cope up with subject and provided with positive encouragement to improve in their performance so that this will not lead to severe anxiety on the students. Math anxiety will result to avoiding math – related tasks

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solving math problems and choosing math – related courses (Rameli et al., 2014). These behaviors of students will result to a poor performance in math.

Table 2 shows that there is a moderate level of math anxiety experienced by the respondents based on the overall weighted mean of 2.85 with an overall standard deviation of 1.242. However, there are identified areas wherein the respondents had very high level of anxiety such as on the idea of taking math section during the college entrance exam with a weighted mean of 4.40 and a standard deviation of 1.074. This is a concern of students because they feel that they are not yet ready for college entrance test since they feel that their knowledge is not enough to meet the standards for college entrance exam. They still have a lot of things to learn in Math.

Table 2. Level of Math anxiety of the respondents

S/N	Indicators	$\bar{x}$	sd	Verbal Description
1	Studying for a math test.	2.79	1.166	Moderate
2	Taking math section of the college entrance exam.	4.40	1.074	Very High
3	Taking an exam (quiz) in a math subject.	2.19	1.137	Low
4	Taking an exam (final) in a math subject.	3.21	1.347	Moderate
5	Picking up math textbook to begin working on a homework assignment.	2.69	1.098	Moderate
6	Being given homework assignments of many difficult problems that are due the next class meeting.	4.18	1.065	High
7	Thinking about an upcoming math test 1 week before.	2.08	1.077	Low
8	Thinking about an upcoming math test 1 day before.	3.31	1.259	Moderate
9	Thinking about an upcoming math test 1 hour before.	3.35	1.170	Moderate
10	Realizing you have to take a certain number of math classes to fulfill requirements.	3.49	1.201	High
11	Picking up math textbook to begin a difficult reading assignment.	2.24	1.324	Low
12	Receiving your final math grade.	3.20	1.521	Moderate
13	Opening a math or stat book and seeing a page full of problems.	3.26	1.199	Moderate
14	Getting ready to study for a math test.	2.56	1.200	Low
15	Being given a “pop” quiz in a math class.	3.56	1.301	High
16	Reading a cash register receipt after your purchase.	2.34	1.222	Low

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17	Being given a set of numerical problems involving addition to solve on paper.	2.20	1.504	Low
18	Being given a set of subtraction problems to solve.	2.35	1.379	Low
19	Being given a set of multiplication problems to solve.	2.45	1.311	Low
20	Being given a set of division problems to solve.	2.95	1.311	Moderate
21	Buying a math textbook.	2.90	1.356	Moderate
22	Watching a teacher work on an algebraic equation on the blackboard.	2.76	1.305	Moderate
23	Enrolling for a math class.	2.44	1.301	Low
24	Listening to another student explain a math formula.	1.96	1.068	Low
25	Walking into a math class.	2.41	1.166	Low
	Overall Weighted Mean	***2.85***		**Moderate**
	Overall Standard Deviation		***1.242***	

Legend:4.21 – 5.00 Very High 3.41 – 4.20 High 2.61 – 3.40 Moderate 1.81 – 2.60 Low 1.00 – 1.80 Very Low

On the other hand, being given homework assignments of many difficult problems that are due the next class meeting, realizing that they have to take a certain number of math classes to fulfill requirements and being given a "pop" quiz in a math class, had brought a high level anxiety to the respondents with a weighted mean from 3.49 to 4.18 with standard deviations from 1.065 to 1.301.

As reflected in the level of anxiety of the respondents, they are worried when they are given math-related activities. Solving math problems are always the struggle of students and most students have negative attitudes towards math problems. In the same way that they avoid taking math subjects if they have a choice. However, when they are required to enroll in math-related subjects, they tend to develop the anxiety because most students have bad experiences in math like failing in math exams.

Table 3 presents the test of significant relationship between math anxiety and academic performance of the respondents in Math.

Table 3. Correlation Analysis between Math anxiety and academic performance of the respondents in Math

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Variables	r-value	Strength of correlation	p - value	Decision	Remarks
Math Anxiety and Performance in Math	-0.554**	Moderate Negative	0.000	Reject Ho	Significant

**significant at p < 0.01(two – tailed)

As presented in the table, the computed value of Pearson r is -0.554 which means that there is a moderate negative correlation between the math anxiety and the academic performance of the respondents. This could mean that when the respondents experience higher level of math anxiety the lesser their performance in Math. Moreover, the p-value of 0.000 which is less than 0.01 ($p < 0.01$) signifies that the null hypothesis is rejected. This means that there is a significant relationship between math anxiety and the academic performance of the respondents in Math. Students' performance is affected by the anxiety that they experience in learning Math. Those who have higher anxiety are expected to perform low in the subject because anxiety would lead to a negative behavior in class. Moreover, there are more female respondents who participated in the study which could possibly contribute to the higher anxiety level that is measured in this study. Devine, et al. (2013) found in their study that female students had higher math anxiety compared to the male students. This finding is consistent with the study of Stankov, et al. (2012) who found that math anxiety is a significant predictor of math performance. Moreover, low performance is evident on the students and manifested by poor behavior in class whenever teachers discuss lessons in math. Most students who experience math anxiety have low confidence in their math ability and tend to take little number of required math courses in college which limits their career choice options.

Conclusion

With the results and findings of the study, math anxiety has shown to have a negative impact on the academic performance of the students. Even though the anxiety that students presently experience was moderate, it needs to be reduced because if this is not addressed, prolonged exposure to anxiety can have more damaging effect on their performance. Thus, it is important that teachers help students lessen the anxiety they experience if teachers aim to enhance the students' performance in Math. In this way, teachers could help students to overcome their math anxiety and explore different strategies to let the students feel comfortable in learning math (Ramirez et al., 2016). Moreover, teachers can let the students explore different problem solving strategies that they can utilize when engaging in different math related tasks in order to build their confidence in learning the subject.

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