

IMPROVING THE MATHEMATICS PERFORMANCE OF GRADE 11 AMETHYST STUDENTS OF BAL-ASON NATIONAL HIGH SCHOOL THROUGH PROJECT RAY-MATHHTINIK

¹Renato M. Escolano, ²Mary Irine Rose J. Maceda, ³Lorina M. Briones

¹²³Bal-ason National High School, SDO Gingoog City

*Corresponding Author's Email: renato.escolano1970@deped.gov.ph

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ABSTRACT

Project RAY-MATHHTINIK aimed to help Grade 11 General Mathematics students reduce their math anxiety and raise their mathematics performance of Grade 11-Amethyst students of Bal-ason National High School (BNHS), Division of Gingoog City, Misamis Oriental for the school year 2022-2023. This action research is anchored on the constructivist theory of learning and implemented Project Ray Mathtinik, which used the ThatQuiz Application to enhance the skills in General Mathematics of the 18 students. A teacher-made test-validated questionnaire consisting of 40 items was designed that served as the pretest and posttest. Frequency and mean were used to determine the students' performance in the pretest and posttest. The t-test was used to determine the significant difference in the students' performance before and after the treatment. Subsequently, the findings of this study have proven the effectiveness of the ThatQuiz Application, which was the tool used by Project Ray MathTinik to increase the students' performance in Mathematics and reduce their math anxiety.

Keywords: *Mathematics Performance, Technology-Based Intervention, Math Anxiety, Action Research*

INTRODUCTION

It is essential to master the basic concepts in Mathematics. It enables the learners to quickly understand the problematic lessons as they progress through the quarters and even into higher grade levels. Suppose students do not have a strong grasp of the basic Mathematics foundation. In that case, it will be challenging for

them to understand higher mathematics, and learning it is highly annoying to them, especially those with a poor foundation.

These are the underlying factors why Filipino students worldwide had minimal competency in Mathematics during the PISA assessment. They are among those with the lowest exam results worldwide. The nation has taken part in the 2018 Program for International Student Assessment (PISA) has shown that less than 20% of students in Mathematics showed the minimum level of proficiency. Hence, more than 50% had very low proficiency at this level (Level 2) (below Level 1).

These Filipino students have evidently achieved below the PISA's lowest level of competency; more than half of them in this age range are left behind in mathematical education compared to their peers in other parts of the world. (Department of Education 2019).

The Philippine performance standard for mathematics requires students to achieve at least a 75% proficiency level at the end of every school year, and the students' cumulative grades are evaluated. If the students pass or earn at least 75%, they can move to the next level. (Dep Ed Order No. 13, s. 2018. However, only a small percentage of my Grade 11 Amethyst Mathematics class students could meet this standard. 18 students failed in Mathematics during the second quarter period.

Precisely, 18 out of 48 or 38% of the students in Grade 11-Amethyst could not pass the 2nd grading period in Mathematics. The researcher then interviewed the said students because they failed in the subject. Most of them revealed that they failed because they have developed anxiety and discomfort towards the subject due to its inadequate and lack of foundation. Thus, these 18 students yield to Mathematical anxiety and cannot comprehend higher Mathematics.

This phenomenon was strengthened by Yeo et al. (2015) based on their study, which found that one of the primary obstacles preventing students from achieving competency and mastery in mathematics is anxiety. Math anxiety reduces one's ability to focus on mathematical computation, as cognitive processing becomes impaired by irrelevant environment stimuli. (Luttenberger et al.,2018). These impairments decrease the fluency or ability to approach computations efficiently and systematically (Paechter et al.,2017).

With this in mind, the teacher researcher explores and puts into action an intervention project called **RAY-MATHINIK (Reducing Mathematics Anxiety that Yields to improve students' Mathematical Ability Through Hands-on with That Quiz application Instruction Needed to Improve their Knowledge)** to address the problem. This project aims to help the students become more mathematically proficient, reduce their math anxiety, and raise their math grades from 75% to 80% for the two succeeding quarters of the School Year 2022-2023.

FRAMEWORK

That Quiz is a tool Project RAY-MATHHTINIK uses as an intervention to help students master essential Mathematics. It is a mobile application that replaces paper activities by giving exercises and drills to the students to discover and master Mathematical concepts. Meagan (2018) cited that the **That Quiz** is helpful for differentiation and remediation and provides alternative assessment forms. This application can also be used even without an internet connection, where students can easily use and access any of their convenient time to master and understand Mathematical concepts.

That Quiz is a 19.33 MB software that was released on the 20th day of December 2016. It was updated on June 14, 2019, with the latest version, 2.7.2, available for download in the Google Play Store. This application is compatible with both iOS (for iPhones) and Android operating systems. i.e., Huawei and Samsung. Eventually, the researcher looked forward to using this tool to improve students' and teachers' classroom and homework routines.

Given the importance of educational technology, knowing how to use technology best to enhance mathematics learning is essential (Cheung & Slavin, 2013). As called for in the Technological Pedagogical Content Knowledge (TPAK) standards and development model, embracing a new technology requires a need to reassess the technology based on three criteria: (1) its effect on the teaching and learning of Mathematics, (2) changes in instructional pedagogies required to facilitate the technology, and (3) effect on content knowledge building.

In the Philippines, Etcuban and Pantin`ople (2018) experimented with the effect of mobile applications in teaching high school Mathematics—quasi-experimental research using the pretest-posttest design with two groups (the experimental and the control groups). The study showed that there was an increased learning in the experimental group exposed to the use of the mobile application.

The That Quiz application assisted students in learning fundamental Mathematics with less hassle since they can use the application with or without the internet at any cause.

MATERIALS AND METHODS

The participants of this study were identified 18 Grade 11-Amethyst students of Bal-ason National High School. To gather all the needed data, the researchers conducted a pre-test, a teacher-made test, as the baseline performance of the target participants. On the other hand, the **ThatQuiz** application was

introduced to them during the implementation phase. Then, in the posttest, the same instrument used in the pretest, a teacher-made test, was again given to them.

Subsequently, the researchers have also measured the anxiety level of these 18 respondents using the adapted tool from MARS-S consisting of 15-item anxiety questionnaires. Then, finally, the gathered data were processed and analyzed using the t-test to compare if there was a significant difference in the students' performance before and after the intervention.

Specifically, ThatQuiz was a tool used by Project Ray MathTinic as an intervention to help our 18 respondents master essential Mathematics. Hence, they have difficulty understanding higher Mathematics because they lack the foundation of the subject even though they have reached the 10th year of Junior High School.

To assess and monitor the output of the students using the **ThatQuiz Application**, the students must Screen-shot the result and send it to the researchers through their messenger group chat. Then, to evaluate the learning progress of these 18 respondents, a worksheet prepared by the researchers was given to them for an actual evaluation of the presence of the researchers since TheQuiz Application was a self-drive application that they could use with or without the presence of their teacher.

For instance, a sample worksheet was provided and found in the appendices on pages 35-38 as a reference only since anyone who wishes to use this study in their class can modify, innovate, or construct their own questionnaires. Meanwhile, the questions and exercises focused only on the mastery of essential Mathematics, which was the foundation of understanding higher Mathematics because we suited them to the needs of our respondents.

RESULTS AND DISCUSSION

On the Performance of the Students Before and After the Intervention

Table 1 shows the performance of the students before and after the intervention. Three out of 18 students, or 16.7%, belonged to the poor performance, and 15 out of 18 students, or 83.3%, belonged to the fair performance before the intervention.

However, after the intervention, 2 out of 18 students, or 11.1%, belonged to the satisfactory performance, 11 out of 18 students, or 61.1%, belonged to the very satisfactory performance, and 5 out of 18 students, or 27.8 %, belonged to the excellent performance.

Table 1. Math Performance Before and After the Intervention

RANGE	PRETEST			POST TEST		
	N	%	QI	N	%	QI
32-40	0	0	Excellent	5	27.8	Excellent
24-31	0	0	Very Satisfactory	11	61.1	Very Satisfactory
16-23	0	0	Satisfactory	2	11.1	Satisfactory
8-15	15	83.3	Fair	0	0	Fair
0-7	3.0	16.7	Poor	0	0	Poor
Total	18	100		18	100	
Mean			10.50	Mean		30.00
Description			Fair	Description		Very Satisfactory

The pretest mean score was 10.50, and the posttest mean score was 30.00, with an increased mean of 19.50. This implied that there was an increase in students' performance in Mathematics after the intervention.

On the Mathematics Anxiety Level of the Students Before and After the Intervention

Table 2 shows the result of the Math anxiety level of the students before and after the intervention.

Table 2. Level of Math Anxiety Before and After the Intervention

Indicators	Pre-Anxiety		Post-Anxiety	
	Transmuted Mean	QI	Transmuted Mean	QI
1. Do you feel unusual nervousness when doing or thinking about Math?	3	High Anxiety	1	Slight Anxiety
2. When calling on to answer Math's math-related questions, do you feel panic or cold?	3	High Anxiety	1	Slight Anxiety
3. Do you have visible signs of nervousness (sweaty palms, shaky hands, and so on)?	2	Moderate Anxiety	1	Slight Anxiety
4. Do you "fear missing out" during math tests?	1	Slight Anxiety	1	Slight Anxiety

5. Despite having good preparations, do you lack confidence in Math?	3	High Anxiety	1	Slight Anxiety
6. Do you suffer from fear of failure in math?	3	High Anxiety	2	Moderate Anxiety
7. Do your parents/ teachers expect much from you, especially in math?	2	Moderate Anxiety	2	Moderate Anxiety
8. Instead of understanding Math, do you prefer memorizing the process?	3	High Anxiety	1	Slight Anxiety
9. Do you practice Math regularly?	1	Slight Anxiety	2	Moderate Anxiety
10. Do you have trouble sleeping at night, especially before the day of the Math test?	2	Moderate Anxiety	1	Slight Anxiety
11. How often do you forget the lesson which you have just learned?	3	High Anxiety	2	Moderate Anxiety
12. Do you make mistakes on easy math questions that you know very well?	3	High Anxiety	1	Slight Anxiety
13. How often do you have trouble finding words when you are talking to?	3	High Anxiety	1	Slight Anxiety
14. How often do you need to ask someone to repeat instructions or a story because you can't remember what was said first?	3	High Anxiety	1	Slight Anxiety
15. Do you have a fear of Math?	3	High Anxiety	2	Moderate Anxiety
Overall	2.53	High Anxiety	1.33	Slight Anxiety

Almost all students during the pretest had a high level of Math anxiety except Q3, Q4, Q7, Q9, and Q10. However, during the posttest, the Math anxiety level of the students reduced to slight and moderate anxiety.

Likewise, as shown in Table 2, the average mean of the anxiety level of the students before the intervention was 2.53 and 1.33 after the intervention.

It was implied that the mathematics anxiety level of the 18 students of G10-Integrity before the intervention was very often or they had a high level of Mathematics anxiety; however, it reduced to the rarely level or slight anxiety after the intervention.

Yeo et al. (2015) strengthened these findings based on their study, which found that anxiety was one of the primary obstacles preventing students from achieving competency and mastery in mathematics. This was also confirmed by Sheffield and Hunt's (2006) research, which revealed that students who struggled in their Mathematics assessments typically had high levels of Math anxiety.

On the Effectiveness of the Intervention in Improving the Math performance of the Learners

As shown in Table 3, the pretest mean score was 10.50, and the posttest mean score was 30.00 with an increased mean of 19.50. Moreover, the computed t-value was -22.67, less than the computed t-table value with 17 degrees of freedom at 0.05 significant level and a probability value less than 0.05 ($p < 0.05$). It showed a substantial difference between the pretest and posttest before and after using the intervention.

Table 3. Significant Differences in Math Performance using the Intervention.

Comparison	Mean	df	T-Value	Significance
Pre-Test	10.50	17.00	-22.665	0.0195
Posttest	30.00			

Legend: $\alpha = 0.05$ level of significance

This further emphasized that the increased students' performance in basic Mathematics was due to the intervention called **Project RAY MATHTINIK** with the used of the **That Quiz Application**. The study's findings confirmed the results of the study of Etcuban and Pantinople (2018), who experimented on the effect of mobile applications on enhancing students' performance in mathematics.

Another study confirmed the effectiveness of using Math applications like **That Quiz application**, which resulted in increased students' performance in Grade 4 Mathematics in Texas (Zhang et al. (2015). The present study confirmed that using **the That Quiz application in teaching mathematics increased students' performance.**

On the Effectiveness of the Intervention in decreasing the Math anxiety of the Learners

As shown in Table 4, the mean of the anxiety level of the students before the intervention was 2.53 and 1.33 after the intervention. It implied that the mathematics anxiety level of the Grade 11 amethyst students reduced from very often or high anxiety to rarely level or slight anxiety after the intervention.

Table 4. *Significant Differences in Math Anxiety using the Intervention*

Comparison	Mean	df	T-Value	Significance
Pre-Anxiety	2.53	17	6.872	0.000
Post-Anxiety	1.33			

Legend: $\alpha=0.05$ level of significance

Moreover, the computed t-value was 6.872 with 17 degrees of freedom at 0.05 significant level, and the probability value was less than 0.05 ($p<0.05$). It showed a substantial difference between the pretest and posttest before and after using the intervention. This further emphasized that **Project Ray MathTiniK** using the **ThatQuiz Application** in teaching basic mathematics reduced the students' mathematics anxiety level.

These findings were strengthened by Mamolo & Sugano (2023) with their study on "Learning materials that students manipulate and interact with significantly affect Mathematics Performance.", the results revealed that interactive instructional materials like the DIMaC app (Digital Interactive Mobile Application) helped students decreased their learning anxiety in the "New Normal" setup and improve learning gain." Subsequently, another study by Hak (2014) showed the effect of technology implementation as a teaching tool was highly engaging and can reduce students' anxiety. In addition, Soewardini (2019) also found that an information technology-based learning approach reduced Math anxiety in grade 7 students.

CONCLUSIONS

The conclusive results of this study underscore the remarkable effectiveness of the ThatQuiz Application, the primary tool employed by Project Ray MathTiniK. Through rigorous analysis and assessment, the research has robustly demonstrated the positive impact of this application on students' academic performance in the domain of Mathematics. The data collected throughout the research period

consistently reveals a noteworthy improvement in the overall performance levels of students who engaged with the ThatQuiz Application.

The empirical evidence presented in this research conclusively supports the argument that the ThatQuiz Application, as implemented by Project Ray MathTinik, is an effective tool for enhancing both academic performance and emotional well-being of Math students. These findings contribute to the growing body of knowledge on the use of technology in education and provide a solid foundation for school leaders, teachers, and researchers to consider the broader implications of such tools in shaping positive learning experiences for students as they learn Mathematics.

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