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COMMUNITY OF PRACTICE IN MATHEMATICS FOR PEER TUTORING PROGRAM

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Abstract

This case study was conducted in one of the private schools in Bacolod City to examine the lived experiences, practices, characteristics, and difficulties of 12 Grade 8 Students during the conduct of the Mathematics Peer Tutoring Program, six (6) of whom were tutors, and six (6) were tutees. The findings of this study may help educators gain insight on how to foster mathematics proficiency through Peer Tutoring and build a Community of Practice that provides a venue for learners to achieve cognitive and behavioral development. A qualitative study of in-depth interviews, focus group discussions, observations, and journaling helped depict the participants' experiences implementing the Mathematics Peer Tutoring Program. Creswell's Six-Step Procedure of Qualitative Data Analysis was used to generate the themes, namely: Employment of Pre-Assessment Strategies; Development of Mathematical Proficiency; Selection of Conducive Learning Environment; Provision of Motivation for Better Learning Engagement; Strengthening Learning through Corroboration and Collaboration; Test to Test; Proof of Good Conduct; Behavioral Disengagement; The Ripple Effect of Behaviors to Peers; Behavioral Maturation; Stumbling Blocks to Conquer; Strive Against the Odds; and Unwrapping Challenge as Takeaways. The three generated themes to discuss the practices, characteristics, and difficulties: Creating a Community of Learners that Practice Learning Competence; The Impact of Behavior on Academic. Success; and Prevailing over Difficulties. This study revealed that students who engaged in group learning activities such as peer tutoring had a greater understanding of mathematics principles and skills. The findings also showed that the morale and commitment of students were developed, and students became open to developing solutions when confronted with adversity in the program.

Keywords: Peer-Tutoring, Case Study, Mathematics Peer Tutoring Program, Community of Practice.

Introduction

Mathematics is a subject that is indispensable in the school curriculum and is essential in daily living and the study of other subjects [8]. Despite the importance of mathematics in life, it is often described as every individual's least favorite subject. Students usually consider mathematics as an uninteresting subject or a subject that makes someone adept at it looks nerd. It takes plenty of effort to learn mathematics and knowing it does not come intuitively and automatically [15].

The results of several polls indicate that variation in peoples' opinions about the significance and evidentiary difficulty in mathematics exists. The Gallup Poll in the United States reported that in one of the surveys conducted, Americans claim that mathematics is the subject that has been the most beneficial to them throughout their lives [12]. In India, the survey conducted by Cuemath, an e-learning platform that offers Math Tutoring Classes revealed that at least 89 % of parents feel that Mathematics is the most challenging subject for their kids. In comparison, 77 % think that the subject is not taught well in schools [11].

The Organization for Economic Co-operation and Development (OECD) administered the 2018 Programme for International Student Assessment (PISA), a student assessment conducted for15-year-old learners across 79 countries, revealing that the Philippines ranked second-lowest in mathematics. In particular, the Filipino learners garnered an average score of 353 compared to the average OECD of 489[23].

For decades, educational issues have included managing pupils who suffer from mathematical anxiety and those who have difficulty doing arithmetic. The Peer Tutoring Program is one strategy educators know for resolving this issue. In a one-on-one math tutoring program, it is believed that anxiety about doing mathematics problems is mitigated [15]. The enormous number of students with math anxiety will be addressed when a bigger group of tutors who share a common concern, set of problems, or passion for math join the PTP. With that, PTP gets to be integrated with the Community of Practice (CoP). This social system is defined as a group of individuals with a common concern, set of problems, or passion for a specific topic. The goal of

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the individuals who participate in a Community of Practice (CoP) is to intensify their learning in collective knowledge [24].

Hence, this study is determined to examine the lived experiences of six tutors and six tutees at the Grade 8 level during the conduct of the Mathematics Peer Tutoring Program.

Statement of the Problem

This study sought to examine the lived experiences of the Mathematics Peer Tutoring Program of the Grade 8 students in one of the private schools in Bacolod City for School Year 2019-2020.

Specifically, this study aimed to answer the following questions:

1. What are the practices of the Grade 8 tutors and tutees in Math for Peer Tutoring Program?
2. What learning and teaching characteristics do tutors and tutees exhibit in the Mathematics Peer Tutoring Program?
3. What are the learning and teaching difficulties of tutors and tutees throughout the implementation of the Mathematics Peer Tutoring Program?

Methods

Participants of the Study

This study consisted of the twelve Grade 8 Students in one of the private schools in Bacolod City for the School Year 2019-2020.

Six of them were the Tutors, and another six were the Tutees.

The participants were a group who experienced the same phenomenon. This study applied a criterion sampling that required the participants to represent people who have experienced the Peer Tutoring Program in Mathematics.

The Grade 8 class was divided into nine (9) sections, two (2) of which were best classes, and seven (7) were heterogeneous classes. There were approximately 450 students in the grade level.

In selecting tutors, students must be from the two (2) best classes in Grade 8. Their average math grade in grade 7 and first quarter grade in grade 8 must be at least 90. Tutors must have represented the school in a math contest or participated in a math event on or off off-campus. Students must be active tutors during the first two-quarters of the program's implementation, and tutoring attendance was high. Tutors who participated in this study were five (5) females and one (1) male.

In selecting tutees, students must be from the heterogeneous classes with an average Math Grade during Grade 7 and First Quarter Grade during Grade 8 of 70-75. Students must be involved during the first two-quarters of the program's implementation. Tutees who participated in this study were two (2) females and four (4) males.

Tutors in this program tutored their tutees for two-quarters, and the ratio is 1:1.

The participants were informed about the study, and participation was voluntary. The participants were given identifying numbers and pseudonyms, which appeared on the transcriptions of their interviews, journals, and observations.

Research Design

This research utilized a case study to explore the learning and teaching practices, characteristics, and difficulties of tutors and tutees during the implementation of the Peer Tutoring Program in Mathematics. The research approach accurately described the experiences in Peer Tutoring based on the personal accounts of the tutors and tutees involved in the phenomenon.

Data Analysis

Conducting data analysis in qualitative research follows Creswell's six (6) steps [4].

The researcher first transcribed the interviews, optically scanned the materials, typed, organized, and arranged data into various sorts based on the information sources to organize and prepare the data.

Next, the researcher examined the data gathered to determine the tone, overall depth, and credibility.

Third, the researcher used categorizing data by bracketing sections and writing words that reflected each category.

It entailed organizing text data and marking those categories using terms.

The researcher used coding to establish a small number of articles or types that reflected a range of perspectives from the participants, which is the fourth step.

The fifth step is describing and representing themes derived from the data gathered, in-depth discussions of the themes and sub-themes, and analyses of interconnected themes were done.

The last step of the data analysis is an interpretation, where the researcher explains how the narrative output was compared to theories and the study's general literature.

Results and Discussion

This study applied the **qualitative case study approach** to explore the participants' lived experiences and thematic analysis to analyze the data. The codes obtained through content analysis of the participants' data and the themes these codes created are presented below.

1. Practices of the Grade 8 tutors and tutees in Math for Peer Tutoring Program

Learners develop continuously, and their educational demands change as well. Thus, advanced instructional practices ensure the tutoring process's effectiveness and success. The use of a variety of strategies for both learning and teaching was referenced several times during the data collection process.

In this study, the following themes were identified as practices of the Grade tutors and tutees in the Math for Peer Tutoring Program:

A. Employment of Pre-Assessment Strategies

Utilizing the pre-test or assessments to assess the subtopics a tutee does not comprehend or master. Tutees mention their difficulties in the subject so their respective tutors can design a lesson targeting those difficulties.

Pre-assessments give critical information about the student's prior knowledge, abilities, and attitudes [9]. Teachers/tutors need this information to design successful teaching activities. Teachers/tutors must develop strategies to connect present learning assignments to students' previous experiences. A well-designed pre-assessment might provide teachers/tutors with critical insights about the experiences students bring to learning activities and provide the foundation for relevant education.

B. Development of Mathematical Proficiency

The teaching practices of tutors mainly focused on demonstrating mathematical skills to show the correct process of doing mathematics. Tutors recognized that repetition of topics or ideas and translation of difficult words would aid tutees in remembering and comprehending the lesson; making the subject easy before progressively introducing more difficult ones would assist tutors in achieving their tutoring objective.

In the mathematics teaching technique, it is required to organize each element of the teaching system with purpose and benefit so that the bilateral activities of teaching and learning are in the best possible coordination and achieve the best possible teaching effectiveness in mathematics teaching [27]. To develop proficiency in mathematics, a student must participate in an active learning process, conduct continual practice, and seek assistance by attending a tutoring or study group where students can discuss issues together to help overcome the cognitive gap in mathematics [25].

C. Selection of Conducive Learning Environment

Tutors understood that the atmosphere must be free of distractions to improve the teaching process. To ensure that tutees feel comfortable, the degree of strictness shown by the tutor is moderate, and making rules before the tutoring session would aid in regulating the conduct and attentiveness of tutees. Tutees were tutored in their own available time to alleviate stress.

It is critical to create a learning atmosphere where students feel secure, comfortable, and eager to take chances, particularly those who have had unpleasant experiences in conventional classroom settings. Students often characterize supportive learning settings as increasing their feeling of family and boosting their self-esteem, which, when paired with improved literacy skills, allows students to take greater risks in achieving their objectives [14].

D. Provision of Motivation for Better Learning Engagement

Tutors maintain eye contact to ensure tutees are paying attention to the talks. To prevent boredom among tutees and enhance their learning involvement, tutors make discussions and assessments interesting. Extrinsic incentive, such as sweets, is provided by tutors to relieve boredom. To keep concentration, tutors avoid making jokes or being too relaxed. Providing tutoring before expected or planned exams improved tutee motivation and participation.

Motivation is an essential part of student learning engagement [7]. Motivation is seen as both a prerequisite and a necessary component of student engagement in learning. Students' high motivation to learn implies a desire for students to achieve good academic success. Students react differently to intrinsic and extrinsic motivation, and each kind of motivation leads to a different engagement in and with their learning [22].

Furthermore, engagement is a significant indicator of success. Students concentrating on assignments and topics demonstrate that tutors have accomplished their goal and that students are actively involved in the learning process. Because he places value on the subject, engaged students devote themselves to it and perform with excitement and care throughout the learning process. Even when confronted with obstacles when completing an assignment, a student persists in his studies and

discovers personal significance in his work. Student engagement also refers to a student's excitement for the learning process, which provides him with a desire to learn, voluntary participation in the learning process, and the will to succeed [20].

E. Strengthening Learning through Corroboration and Collaboration

Tutors improved their teaching skills by studying the techniques of other tutors. Tutors enhanced their teaching abilities by learning the methods of their math teachers or by searching through the internet. Tutors work together with other tutors to provide integrated knowledge. Tutors create resources to reinforce and explain math topics.

Through Peer Tutoring, students may improve learning via corroboration and collaboration. Peer tutoring is an effective intervention for increasing topic knowledge, and tutees gain understanding via instruction and earn the chance to amend their mistakes. On the contrary, tutors accomplish academic objectives and strengthen their social relationships. Tutors collaborate to solve mathematical difficulties, educate tutees and explain the concepts. Additionally, peer tutoring boosts the self-esteem of tutors in achieving learning goals and developing their social and behavioral talents, such as conversing, sharing, and working with teaching strategies to assist tutees. It benefits low-achieving or struggling students and gifted or high-achieving students to strengthen their learning [19].

F. Test to Test

Tutors assigned tests, assignments, and oral questions to tutees to evaluate their progress in math. Tutees expressed that tutors would discuss the concepts again in math if the post-test given failed.

According to Newton's research, Assessment has been used for various purposes, including placing or monitoring students, improving teaching and learning and providing individual feedback to students [26].

Assessment of student learning provides both instructors and students with vital information regarding how students are effectively meeting course learning goals.

The "Backward Design" of Grant Wiggins and Jay McTighe was used to emphasize the importance of Assessment and how it allows instructors to establish metrics for evaluating students' comprehension and proficiency with course learning objectives [16].

2. Learning and Teaching characteristics exhibited by Tutors and Tutees in the Mathematics Peer Tutoring Program

Positive or negative behaviors expressed may affect everyone in the same setting. It may affect their motivation, temperament, and involvement, all crucial factors when conducting a tutoring program.

In this study, the following themes were identified as the learning and teaching characteristics exhibited by Grade 8 tutors and tutees in Math for Peer Tutoring Program:

A. Proof of Good Conduct

The excellent behavior shown by tutees toward their tutors has a beneficial effect on tutors, mainly while teaching the topic. The good conduct of tutors toward their tutees resulted in a pleasant experience for the tutees in the Peer tutoring program.

Participation in tutoring programs has been demonstrated in studies to enhance both social and behavioral outcomes for low-achieving students and students with behavioral issues. Tutoring improved students' academic performance and study skills, organization, and motivation. Students also benefitted from the chance to connect with peers and student mentors positively and productively, displaying better social skills and time on task. Moreover, participation in peer tutoring programs helped students work as tutors.

Tutors experienced a more excellent feeling of confidence, personal effectiveness and responsibility, and empathy by strengthening and deepening their comprehension of the topic they were coaching. Serving as a peer tutor allowed students to acquire insight into the learning process and a better grasp the essence of helping others [17].

B. Behavioral Disengagement

Disinterested and unmotivated tutees are also included in the Peer Tutoring Program.

Behavioral disengagement occurs if: students fail to follow the rules or expectations in an activity instead of engaging in behaviors outside of the norms or expectations, ceasing to participate in the activity, or participating in an unwanted and inappropriate manner [6]. In recent years, behavioral disengagement plays a significant role and is linked to lesser learning gains in short-term and long-term academic performance and whether learners progress in their academic career years later [9].

C. The Ripple Effect of Behaviors on Peers

The negative and positive qualities shown by tutees in the program impact the instructional involvement of tutors-the negative and positive characteristics of tutors in the program impact tutees' learning engagement.

Peer tutoring is a very efficient technique for students to learn from one another. It benefits students intellectually, but it also assists them in enhancing their communication and interpersonal skills. Students may boost their confidence and become more self-motivated by participating in peer tutoring. Peer tutoring is a two-way street that benefits both the tutors and the tutees.

As a result, it should be used both inside and beyond the boundaries of educational institutions [3]. Furthermore, peer tutoring influenced the students' mathematical self-concepts and revealed substantial gains in their self-concepts. On the contrary, peer assistance may be suitable for students' mathematical self-concepts, but more study is required to examine the effects of peer assistance on students' emotions. In this regard, the potential of peer tutoring is shown in conjunction with other factors such as mathematics performance, mathematics anxiety, or attitude toward mathematics [18].

D. Behavioral Maturation

As the implementation of the Peer Tutoring Program progressed, noticeable behavioral changes among tutees were seen. Observable changes in tutor conduct have been seen as the peer tutoring program's implementation develops. Despite the lengthy implementation of the Peer Tutoring program, there was consistency in unfavorable characteristics of some tutees. Throughout the Peer Tutoring Program implementation, a good number of tutors and tutees displayed consistency in their commendable characteristics and behaviors.

Significant advances in students' educational achievement in subjects derive from their perspective and attitude toward the subject matter. In this context, emotional preparedness and attitude influence students' academic accomplishment [10]. None of the elements influencing learning motivation is more crucial than maturing behaviorally. Moreover, the strongest predictor of educational achievement in math is the attitudinal component of gratification. In other words, students who enjoy being involved in situations that require the use of math and who feel a sense of belonging to mathematics benefit from progress in this tutorial are less anxious when taking math exams, and experience feelings of restlessness. The process of mathematical education has a direct and significant impact on attitudes toward mathematics. Likewise, the structure of beliefs and values has a direct and consequential impact on educational processes and attitudes toward learning mathematics [10].

3. Learning and Teaching Difficulties of tutors and Tutees throughout the implementation of the Mathematics Peer Tutoring Program

The challenges and difficulties encountered in a program do not constitute a program's flaws. Instead, they help determine whether the tutoring program is being used effectively for its intended purpose. The program's primary objective is to address the difficulties and convert them into opportunities.

A. Stumbling Blocks to Conquer

Tutors encountered difficulties contributed by the behaviors and actions shown by their tutees. Because tutors and tutees are regular students, scheduling tutoring sessions became difficult. The problem of tutors in executing the Peer Tutoring Program was attributed to the struggle of teaching preparation and the complexity of the math topic. During the tutoring program, some tutees struggled due to the difficulty of the math topics.

The peer tutors had difficulties with their tutees' dedication, communication, time management, and limited expertise. These difficulties led to several tutors losing their excitement for teaching and their desire to continue serving as peer tutors, thereby impacting the efficacy of the peer-to-peer tutoring program [13].

Peer tutors encounter various difficulties, some of which are the result of insufficient preparation [1].

While some tutors like the informal aspect of tutoring, others may struggle to create and sustain personal relationships. Tutors also feel vulnerable, particularly when students reject their assistance or distrust peer knowledge due to pre-existing beliefs about traditional sources of expertise. Hence, a professor should transfer knowledge to student boundaries, resulting in burnout and overwork.

B. Strive Against the Odds

In the peer tutoring program, tutors discovered methods to handle their challenges. The tutors dealt with the problems of tutees in the tutoring program in a timely and effective manner.

Peer tutoring benefits tutors' subject knowledge by requiring them to invest significant time in locating the appropriate materials and sources to provide well-founded support for tutees, during which they may come across materials that are beneficial to them as well [2]. As a result, students found tutoring to be both challenging and inspiring. To overcome obstacles and be competent in teaching, tutors must thoroughly understand the subjects they are assigned to teach, which involves additional time reviewing and preparing.

Additionally, tutors are more likely to use reference books and other sources to properly carry out their tutoring job.

They are exchanging advice with other peer tutors and instructors, aided in increasing learning as a whole.

C. Unwrapping Challenge as Takeaways

Despite the difficulties tutors had in the peer tutoring program, they discovered the light, allowing tutors to do and comprehend better. Tutees learn from their experiences and challenges in the Peer Tutoring Program and can be applied in life.

Peer tutors developed additional positive characteristics and virtues such as responsibility and patience by engaging with their tutees and reacting to their diverse needs. Tutors were able to create an awareness of their growing personal characteristics due to peer mentorship [2].

Participating in a peer mentorship program may be a developmental challenge that tests one's perceptions of intellectual ability, interpersonal connections, a sense of purpose, and personal identity. Tutors have often been found to be role models for their tutees. Peer tutoring is often recognized as a beneficial experience for both tutors and tutees. It fosters a sense of accomplishment and self-worth among tutors who think they make a big difference in their communities.

Summary

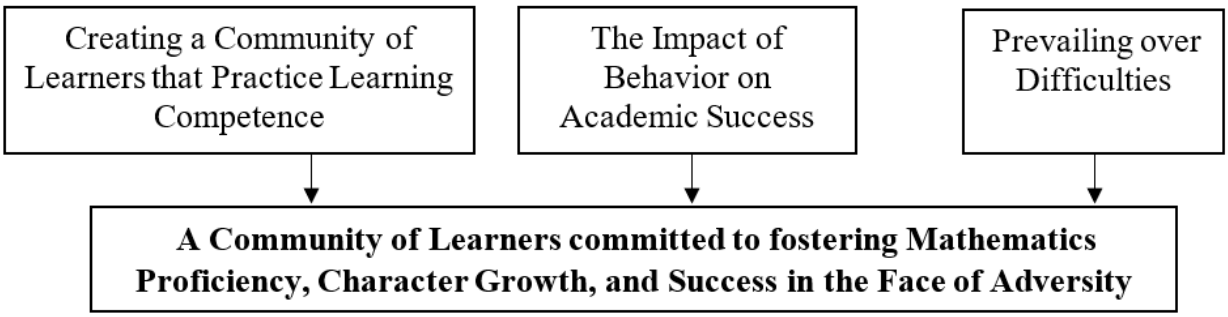
The degree of participation of participants was determined and taken into account when assessing their lived experiences in the Mathematics Peer Tutoring Program. The case study method was used in this research to comprehend the participants' lived experiences, and theme analysis was used to examine the data. **Table 1** provides themes established in the Mathematics Peer Tutoring Program and summarized.

Table 1: Summary of Themes in the Conduct of the Mathematics Peer Tutoring Program

Creating a Community of Learners that Practice Learning Competence	The Impact of Behavior on Academic Success	Prevailing over Difficulties
❑ Employment of Pre-Assessment Strategies ❑ Development of Mathematical Proficiency ❑ Selection of Conducive Learning Environment ❑ Provision of Motivation for Better Learning Engagement ❑ Strengthening Learning through Corroboration and Collaboration ❑ Test to Test	❑ Proof of Good Conduct ❑ Behavioral Disengagement ❑ The Ripple Effect of Behaviors to Peers ❑ Behavioral Maturation	❑ Stumbling Blocks to Conquer ❑ Strive Against the Odds ❑ Unwrapping Challenge as Takeaways

The diagram in Figure 1 depicts the relationship of the themes developed in response to the research questions. To provide identity to the objective of this case study, one topic encapsulates all of the other themes.

Figure 1: An Illustration Showing The Theme and Sub-Themes Raised in The Conduct of the Mathematics Peer Tutoring Program



Conclusion

The Mathematics Peer Tutoring Program enabled the students to shape communities or groups around a common goal: to develop proficiency in mathematics. The tutees discovered a group of tutors who could assist them in developing their skills, addressing their problems and anxieties, and influencing their attitude toward the subjects.

Peer tutoring has become an essential intervention for students with learning disabilities in mathematics. Students who engaged in group learning activities such as peer tutoring had a greater understanding of mathematics principles and skills. All students benefitted from peer tutoring. It allowed tutors to master course topics and openly share their ideas, while tutees reinforced and improved their performance to understand the lessons better. Peer tutoring assisted students in strengthening valuable skills such as eagerness to learn, resourcefulness, and time management.

The morale and commitment of students were developed due to the tutoring programs. Having a desire for math proficiency increased the willingness and eagerness of tutees to learn. A good way of acquiring mathematical skills is when activities are carried out in a welcoming learning atmosphere - a quiet, comfortable atmosphere supported by knowledgeable tutors. The tutors made effective use of their teaching materials to reflect skills and assess math learning competence. They were mindful of the strengths and potentials of the mathematics they were teaching.

Additionally, the cognitive preparedness of the tutors helped an environment to be fluent in mathematics. Apart from the skills to be learned, it is often essential to reassure and motivate tutees. Growing engagement and inspiration aided the tutoring program in accomplishing its goals.

A peer tutoring program aims to assist students in increasing their proficiency and developing into better learners through social growth. Both tutors' and tutees' behaviors and personalities significantly affected their peers. Additionally, students' disengaged behaviors can disrupt their commitment and motivation, making tutoring them more difficult.

Recognizing challenges and developing solutions to address or solve them will make or break students' progress when confronted with adversity in the program. Challenges are an inherent part of any program, but they can always be conquered. Moreover, the tutors enjoyed the ability to impact students positively. Despite the difficulties, most tutors who were interviewed agreed or strongly agreed that their tutoring experience was meaningful.

The Mathematics Peer Tutoring Program built a community of learners committed to fostering mathematics proficiency, character growth, and the student's perseverance in the face of adversity. Students' responsibilities and objectives provided a firm foundation for developing communities of practice. Grouping participants of these communities may accomplish the sharing of best practices and new information to promote a specific area of instructional experience. Similarly, developing a culture of expertise among tutoring students will amplify the tutoring program's effect on the entire community.

Thus, tutors are paired with peers to expand their math skills and knowledge, and tutees will be introduced to a more inclusive learning environment.

Conflict of Interest

There is no conflict of interest between the authors in this manuscript.

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