



The Effects of Peer Tutoring on the Mathematics Academic Achievement of Grade 10 Students: A Basis for Intervention Program

Saniata B. Lagmay, LPT¹, Melissa B. Bacena, MOM²

^{1,2}University of La Salette Incorporated

ABSTRACT

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Students with difficulties learning mathematics can be found in almost every classroom. Hence, many educators are constantly striving to improve their students' classroom achievement. One potential solution is using peer tutoring. This research focused on the effects of peer tutoring on students' academic achievement in learning Mathematics. Five research questions and Four hypotheses were formulated to guide the study. This study utilized the pretest-posttest with control group quasi-experimental research design, involving a sample of 60 Grade 10 students of University of La Salette Inc. High School who were selected based on their 2nd quarter grade. Simple random sampling by fishbowl technique was also employed to assign students to either control or experimental group, and the same method was employed in pairing the students. The experimental group received peer tutoring, while the control group was taught using the conventional lecture method. To gather data for analysis, a researcher made questionnaire Mathematics Students Achievement Test (MAT) was crafted based on the 3rd quarter lessons as stipulated in the curriculum guide set by DEPED and validated by five experts, demonstrating a reliability index of 0.792 as determined by Kuder – Richardson formula (KR-20) which means reliable. After five weeks of intervention, post-test was given to both groups to measure and assess learnings and effectiveness of peer tutoring. The post-test was just similar to the pretest. The result of the post-test was recorded and compared with the results of the pre-test to see if there is an increase in the scores of the students and to determine the effect of the intervention in the achievement of the students in Mathematics. The data were analyzed using mean, standard deviation, paired sample t-test, and t-test for independent which were tested at 0.05 level of significance. Moreover, Cohen's d was also used to determine the effect size of the peer tutoring. The result of the findings unveiled that the participants to both group, control and experimental group showed that there is a significant difference occurred in students' academic achievement which means that there is an improvement in the academic achievement of students after the interventions. However, students who were exposed to peer tutoring with Cohens $d = 1.07$ (large effect) achieved higher scores and exhibited notably superior performance compared to those who exposed to the traditional talk and chalk teaching method with Cohens $d = .483$ (small effect) which implies that even if there is a significant difference of the scores of the students exposed to traditional teaching, the effect size indicates that there is only a small effect or small improvement. In connection to the findings, the study recommends that teachers should explore more strategies and interventions that will help students in learning mathematics to achieve better academic achievement in the said subject. And since, peer tutoring demonstrated greater effectiveness and contributed to heightened mathematics achievement compared to conventional teaching methods, it is recommended that mathematics educators should embrace and adopt this as an intervention program to help students improve their academic achievements in Mathematics. Future researchers should encompass a larger sample size, different research locations, and additional factors that were not considered in the present study. Moreover, other techniques that help students perform better in mathematics should be explored.

KEYWORDS:

peer tutoring, traditional teaching method, academic Achievement in mathematics, effect size

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INTRODUCTION

Mathematics is considered as one of the essential subjects in the K-12 basic education curriculum in the Philippines and all over the world. Mathematics is more than just numbers and equations; it is a gateway to a world of possibilities. It is a tool that empowers everyone to think critically, solve problems creatively, and approach challenges with confidence. In this world, those who understand and can do mathematics will have more opportunities that others do not. This is a subject that prepares the students for the future as well, regardless of which work of life they choose to be part of. According to Samuel (2021) it is the foundation of scientific and technological knowledge that is vital in all fields of life. Similarly, Ogoke, Otumegwu, & Nwaneri (2022) further emphasize that it is an essential requirement by every field of intellectual endeavor and human development and the society as a whole. Indeed, the survival of any human being in this competitive world is almost impossible without the knowledge and skill in mathematics.

Despite the wide applicability and importance of Mathematics in the society, Filipino students consistently struggle with mathematics, as evidenced by their performance in local, national, and international assessments Callaman & Itaas (2020). Based on the National Achievement Test it showed that mathematics scores of Filipino students remain below standards (DepEd, 2019). Moreover, the Philippines has consistently faced significant challenges in mathematics education, as evidenced by its rankings in international assessments. Even before the pandemic, the country was already performing poorly, ranking lowest among participating nations (San Juan, 2019). In the PISA 2018 International Report, Filipino students achieved an average score of 353 points in mathematical literacy, far below the OECD average of 489 points, indicating a proficiency level below Level 1 (OECD, 2019). Similarly, in the 2019 Trends in International Mathematics and Science Study (TIMSS), the Philippines scored 297 points in math, reflecting one of the lowest performances globally (Mullis et al., 2019). More recently, in the PISA 2022 assessment, the Philippines again ranked near the bottom, placing 76th out of 81 participating countries, with Filipino students averaging 355 points in mathematical literacy, still significantly below the OECD average of 489 points. These results show that Filipino students have consistently struggled with mathematics compared to other countries around the world. Although various studies have

analyzed the causes of low performance and proposed recommendations, low mathematics achievement persists across all educational levels. Abdelkarim, Abuiyada, & Siddiui, (2016) emphasize that the low achievement in mathematics at both school and university has increasingly become a disturbing phenomenon that needs to be urgently addressed.

In response to these challenges, mathematics Teachers are in constant quest of finding strategies and interventions to meet the diverse needs of the learners and improve students' achievement in learning mathematics. One recognized method for improving performance is peer tutoring, a strategy that enables proficient students to support their peer (Mahanta, 2019). Chong et al. (2020) describes peer tutoring as an interactive learning process in which a proficient student (tutor) assists a fellow student (tutee) who is facing challenges in the same subject area. Chiew (2021) finds peer tutoring particularly effective for students with weaker academic backgrounds. It is one of the 21st -century teaching strategies in Mathematics that can help to remove the anxiety and respond to the needs of the students towards the subject, thus increasing their academic achievement.

Background of the Study

The University of La Salette High School is a Catholic school in the region that promotes quality education. However, In the transition to K-12 spiral curriculum and especially after the covid-pandemic where most schools need to shift to modular and online class set-up, it has been observed that students face difficulties in performing mathematics and portrayed poor academic performance up unto present. Attempts have been made to counter the problem of poor performance in mathematics in our school. For instance, remedial and enrichment programs are employed every Friday aiming to improve the achievement of the students but still poor performance in the subject remains a persistent issue. With this, teachers are encouraged to make intervention plans to struggling students in order to overcome learning difficulties in math subjects, one promising option is peer tutoring.

A growing body of evidence suggests that peer tutoring has been demonstrated to have positive effects on cognitive outcomes. The effectiveness of peer tutoring in learning demonstrates that they are valuable tools for improving student learning and achievement Ul Ain, et al., (2023). Several studies also have assessed the effects of peer tutoring on mathematics anxiety, attitudes towards mathematics or mathematics self-concepts Topping et al. (2017). However, few studies have focused on examining how peer tutoring impacts on the academic achievement of the students, especially in the Philippine context, remains limited. Moreover, most studies on peer tutoring in mathematics focus on primary education, while research in upper educational levels, such as high school, or college, is

Corresponding Author: Saniata B. Lagmay

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not as abundant and extensive Moliner & Alegre, (2022); Johnson (2019) which presents a need for continued research. Furthermore, according to Huff (2021), many secondary schools are interested in having peer tutoring programs implemented for mathematics and many claim that peer tutoring is effective in these settings, however, there is little research in this area to support these claims. Similarly, Arthur, Boadu, & Asare (2022) claims that in spite of the abundance of existing literature and that there is a wealth of current material on peer tutoring in mathematics, implications for practice at the secondary education level have not been addressed thoroughly and the evidence supporting tutoring in mathematics in secondary is not extensive which led to the need for more research on the topic. It is the reason why the researcher would like to investigate the effects of peer tutoring to the academic achievement in mathematics of junior high school students, particularly the grade 10 students with the aim of improving their achievement in learning mathematics.

Research Questions

1. What is the mean pre-test and post-test scores of the participants in the
 - 1.1 Control Group who are exposed to traditional teaching?
 - 1.2 Experimental Group who are exposed to peer tutoring?
2. Is there a difference in the mean scores between the control group (traditional teaching) and the experimental group (peer tutoring) in
 - 2.1 Pre-Test?
 - 2.2 Post-Test?
3. Is there a difference between the pre-test and post-test mean score of
 - 3.1 Control Group?
 - 3.2 Experimental Group?
4. What is the effect size of the peer tutoring on the academic achievement of the participants?
5. What mathematical intervention can be proposed to improve the academic achievement of the participants?

Research Hypothesis

1. There is no significant difference in the pre-test mean scores of the experimental and control group in the achievement test of Mathematics;
2. There is no significant difference in the post-test mean scores of the experimental and control group in the achievement test of Mathematics;
3. There is no significant difference between the pre-test and the post-test mean scores of the control group;
4. There is no significant difference between the pre-test and the post-test mean scores of the experimental group.

Significance of The Study

The findings of this study will be of great help to the following who have anything to do with the success or failure of the students in school; school Administrators, mathematics teachers, students, parents, curriculum developers and future researchers.

School Administrators. This study can provide insights to support the implementation of peer tutoring programs as an effective strategy to enhance mathematics achievement. The school administrators can use the results of this study in planning for innovation as it provides additional inputs and will help them look into some ways of making math instruction meaningful to students and will guide them as well to identify on the needs of the school along the area of teacher's training, instructional materials and facilities, professional training and teacher education programs that can enhance mathematics learning in the school.

Mathematics Teachers. This study will provide the basis for mathematics educators towards the adoption of peer tutoring as a measure against poor academic achievement. The study can provide insights about effective peer tutoring techniques, such as selecting and training tutors, and structuring tutoring sessions. This research can also help teachers enhance their instructional practices and create a more supportive learning environment, leading to improved student learnings.

Students. Students stand to gain the most from this study since it can result in better academic achievement, a deeper comprehension of mathematics, increased confidence, and a more supportive learning environment.

Parents. By knowing the positive effects of peer tutoring on their children's academic achievement, parents can encourage their children to participate in this kind of program.

Curriculum Developers. Curriculum developers can use the study's results to design or modify educational materials and curricula to incorporate effective peer tutoring strategies. The findings will serve as information that can contribute to the development of curricula to better address diverse student needs and promote collaborative learning approaches.

Other Researchers. The study provides insights about the effectiveness, implementation strategies, and potential areas for further investigation about peer tutoring. This result will also give them more insights and ideas on thinking about new useful research that will help not only the respondents, but also to the community.

THEORETICAL BACKGROUND

Theoretical Framework

Three sets of theories are relevant to this study: Vygotsky's Social Constructivism, Bandura's Social Learning Theory and Cognitive Apprenticeship.

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Vygotsky's Social Constructivism Theory. This Theory emphasizes that social interaction plays a major role in learning. He claimed that individuals learn and construct knowledge through interaction with others, rather than in isolation. Peer tutoring aligns with this theory by providing a supportive environment where students can learn from each other and progress beyond their individual capabilities. This concept relates to peer tutoring which is also connected to Vygotsky's Zone of Proximal Development (ZPD). The Zone of Proximal Development (ZPD) refers to the range of tasks that a learner can accomplish with assistance but not on their own. It is also about the difference between what a student can accomplish on their own and what they can accomplish under the supervision of a more experienced person, like teacher or a peer. Just like in peer tutoring, it offers a valuable opportunity for students to interact with each other, share ideas, and collaboratively solve problems and aside from that the tutor gives the tutee support, clarifications, and guidance while providing scaffolding, or temporary help, to help them finish assignments. This process not only supports the tutee's learning, but the tutor also enhances their own understanding by preparing lessons and explaining concepts, while the tutee benefits from the support provided within their ZPD. Thus, this collaborative process fosters a deeper level of understanding for both parties, which can lead to improved academic performance Ali, Anwer, & Jaffar (2015). According to Kalina (2009) as mentioned by Nawaz & Rehman (2017) that social constructivism enhances learning through active social interaction and conversation. In a peer tutoring environment, tutors and tutees strengthen their social bonds through effective communication, improving their understanding and fostering cooperation. Sometimes, a peer's explanation may be clearer to a student than a teacher, as peers often explain concepts in simpler terms. This collaborative communication process helps both students, embedding fundamental cognitive skills in their interactions. In this way, peer tutoring embodies the key elements of Vygotsky's theory, promoting cognitive and social growth through active learning and mutual support.

Another theory that supports the study is the Social Learning Theory of Albert Bandura that emphasizes the role of social interactions in the learning process. According to Bandura, learning occurs through processes such as observation, imitation, and modeling, where students absorb new behaviors and strategies by watching others. This theory aligns well with the objectives of peer tutoring, where students (mentees) learn by imitating the behaviors and techniques modeled by their more experienced peers

(mentors). According to Luca & Clarkson (2002), peer tutoring is aligned with these aspects by enhancing social negotiation with the student tutor and tutee, where knowledge construction is promoted through communication and dialogue, which is helpful for the tutees. Moreover, peer tutoring facilitates vicarious reinforcement, as students witness the positive outcomes experienced by their peers—such as praise or academic success—and are motivated to adopt similar approaches. (Abdellkarim & Abuiyadu, 2016). Finally, peer tutoring presents the tutees with ample opportunity to practice solution strategies to mathematics problems in a conducive environment facilitating not just mastery of content but formation of positive attitude towards mathematics learning activities Ouko & Aurah (2015).

Another theory is Cognitive Apprenticeship. This theory suggests that learning is facilitated when students work alongside more knowledgeable individuals who guide them through the learning process. In peer tutoring, the more experienced peer serves as an "apprenticeship model" who provides coaching, feedback, and scaffolding to help the less experienced peer grasp complex mathematical concepts. The apprenticeship model shares expertise and encourages metacognition, fostering better understanding and skill development eventually allowing the tutee to take on more independent problem-solving. While working with the master which is the peers, the apprentices observe others during task completion and get actively engaged instantaneously at their own developmental level. According to Cognitive apprenticeship consists of four main components: modeling, coaching, scaffolding, and fading. Modeling involves demonstrating how to perform a complex skill or task, while explaining the rationale and steps involved. Coaching involves providing feedback, hints, prompts, and questions to help learners monitor and improve their performance. Scaffolding involves providing tools, resources, and strategies to help learners accomplish a task that is beyond their current ability. Fading involves gradually reducing the amount and frequency of support as learners become more independent and confident.

Conceptual Framework

The main purpose of this research is to find out the effects of peer tutoring on students' academic achievement in learning mathematics.

The conceptual framework of the study is presented below. This will be the flow of the work to yield answers to the research questions.

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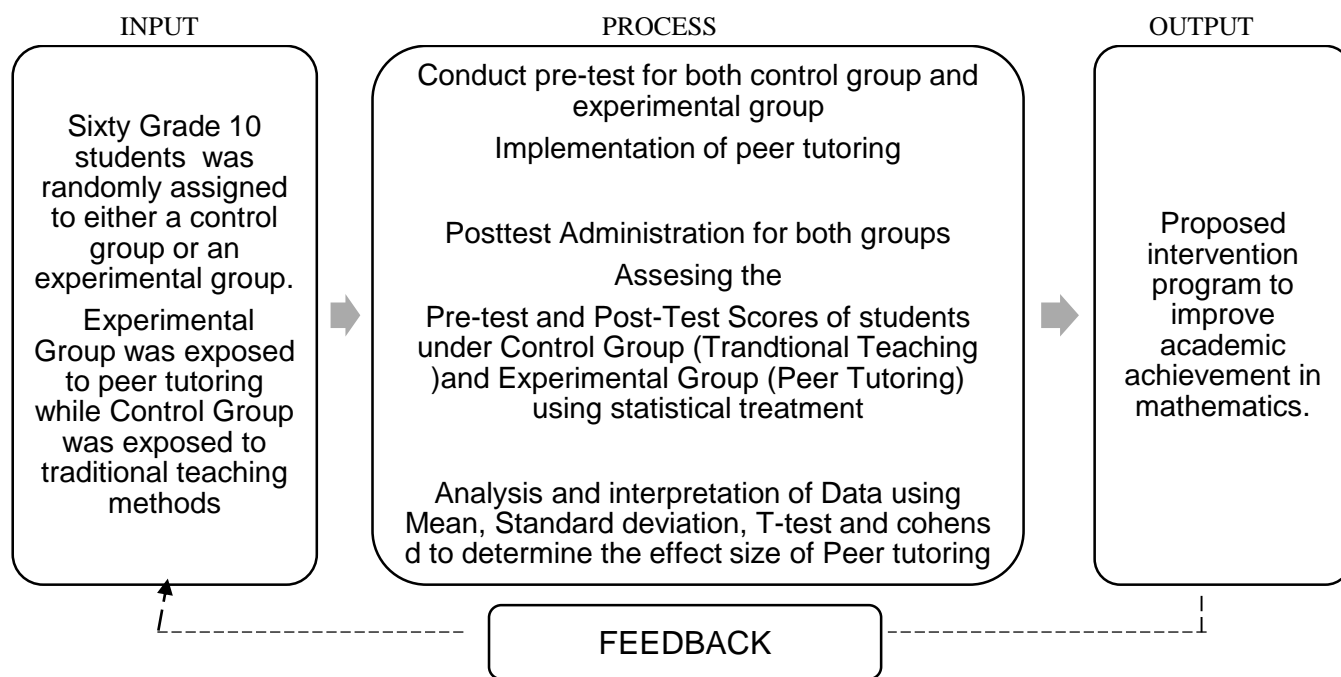


Figure 1. Conceptual Framework

As shown in Figure 1, This study is anchored on the basic framework Input-Process and Output. The input frames involve identifying and selecting a sample of Grade 10 students from University of La Sallette High School. These students are then randomly assigned to either a control group or an experimental group. The process stage frame includes the control group receiving traditional instruction, while the experimental group undergoes peer tutoring. Pre-test and post-test, which is a researcher-made Mathematics Achievement Test, were administered to both groups to measure the initial knowledge level and the improvement of the participants after the intervention. The collected data were analyzed and interpreted using central tendency, standard deviation, and inferential statistics like t-tests and Cohen's d to determine the effects of peer tutoring on the academic achievement of students. And lastly, the output frame included the proposed intervention plan developed to enhance students' mathematical achievement.

LITERATURE REVIEW

Mathematics is studied for a variety of reasons. Mathematics teaches students important skills such as problem-solving skills, analytical thinking skills and logical reasoning that they can apply to other aspects of their lives. However, students with difficulties learning mathematics can be found in almost every classroom. And because it is an abstract discipline, many students at all levels of education find it tough and challenging. According to Longjohn and Osila (2022), this may be due to the common approaches adopted by most classroom teachers in the subject which is the lecture method where the teachers start the lesson with introduction of the topic, explaining the basic approaches to

solving some problems and giving the students assignments to work in class and at home. In this kind of learning environment, students struggle to develop their own understanding as they become passive learners, relying heavily on the teacher's input. They are also not able to think innovatively, creatively, and critically since they perceivably received what has been taught to them. This method has consistently proved to be not too helpful to students in their understanding of mathematics, hence there is a consistent poor result in mathematics and the need to try other methods of teaching. Based on this, teachers are challenged to seek for an intervention method that would enhance academic achievement of students in mathematics. Giving students the opportunity to learn and study together is one method to accomplish this. According to Rosdianwinata, Rifa'i, and Nasrullah (2019), the mathematical learning approach that provides opportunities for all students to be able to improve the ability of students to understand mathematics is through peer tutoring.

Abdulkarim, et al. (2022) describes peer tutoring as an instructional strategy in which one student provides instruction or academic assistance to another. It consists of student partnerships, linking the higher performing student to the lower performing student. This is a great way for everyone to learn. Tutors get better at understanding the subject by teaching it to others. At the same time, students get extra help and attention. This interaction not only enhances academic performance, but also develops social and communication skills Awofala and Agbolade (2023). Moreover, training students in peer tutoring strategies fosters responsibility for their own learning and helps them

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recognize and accept responsibility for academic failures (Umar, et al., 2021).

At present, the significance of peer tutoring is increasing, and it has become an important part of diverse courses and different disciplines in many countries, Ali et al., (2015). Peer tutoring has been used across academic subjects (such as language arts, mathematics, science, physics, sports mechanics, social studies, economics), and has been found to result in improvement in academic achievement for a diversity of learners within a wide range of content areas (Lazarus, 2015). According to Wolfe (2018), an important facet of peer-tutoring is the absence of the power dynamic between students and instructors. Tutors attempt to relate to students at their level to make the experience more comfortable and friendly. This is supported by Oloo, Mutso, and Masibo (2016), who found that peer tutoring helps find out that peer teaching and group discussions among students increase the scores for some of the students in the subject due to the following reasons: Peers explain concepts in simpler and understandable terms and according to their level of understanding; Peers can be asked questions and for more explanations freely; and Interact and discuss openly without fear. The responses from the teachers' and learners' questionnaires show that the students' understanding and retention of subject matter is enhanced; and the attitude of the learners towards the subject increases. The following are the responses from teachers; a. Improved attitude, motivation and self-esteem; b. Developing social skills and or solving social problems; c. Discipline is enhanced leading to academic improvement; d. Teamwork is enhanced, students learn to work as a team to achieve the best individual results at the end of their course; e. Leadership quality and group control; f. Positive attitude towards work; and g. Developing communication and public speaking skills. On the other hand, students mentioned the following as some of the characteristics developed in the learners as they undertake peer teaching while learning mathematics: a. Being confident improves self-confidence and self-esteem; b. Strengthens their relationship, unity and understanding leading to friendship; c. Promotes teamwork and positive competition; d. Becoming courageous and developing good oral and public speaking skills; e. Improves discipline, courtesy, persistence, concentration and time management; f. Good moral behavior, responsibility and desire to help others; and g. Students have freedom to interact and develop a positive attitude towards each other. Hence, the high achievement of the students is guaranteed because students are free to themselves unlike when they are being taught wholly by their class teachers. Antwi (2016) agreed with the said findings and found that the improvement in students' performance was due to intense student-student interactions, peer support, active participation of all students in the lessons, maximum teacher support and increased teacher-student interactions.

Many researchers suggest that incorporating peer learning into the classroom offers numerous rewards for teachers, students, and the students being tutored. Lacaba (2018) emphasizes that peer tutoring is a highly effective way for the students to learn from each other. It not only benefits the students academically but also helps the students in developing their communication and interpersonal skills. Ali, Anwer, and Abbas (2015) suggest that peer tutoring provides an opportunity for the students to interact directly with their peers, which encourages active participation and promotes collaborative learning. As a result, students enhance their confidence levels and become more self-motivated. Ullah, Kaleem and Aamir (2020) further highlight that peer tutoring is a two-way process and it is equally beneficial both for the tutors and the learners. Peer tutoring offers both educational and social support to the less knowledgeable students and it also provides an opportunity to students of diverse abilities to work on academic tasks in pairs, in a democratic, cooperative and friendly approach.

Alegre-Ansuategui et al. (2018) conducted a meta-analysis of peer tutoring in math from kindergarten to tertiary revealing that 88% of the studies reported positive effects on academic achievement. Similarly, Letam (2022) investigated the effects of peer tutoring on secondary school students' performance in mathematics in Tai Local Government Area of Rivers State, the findings of the research revealed also that Peer tutoring enhances academic performance of mathematics students; hence students feel more comfortable and open as they interact with their peers. Peer tutoring offers an opportunity for each participant to become aware of their strengths and weaknesses. Moreover, Berso and Lorente (2020) reported that structured peer tutoring activities, such as sessions on quadratic equations, significantly enhanced the performance in the periodic examination of the peer tutored group. This showed that the peer tutored group performed better than those classes that were not peer tutored. Therefore, the session plans with learning activities for peer tutoring were then concluded to give benefits in the learning experiences and enhance the mathematics performance of the learners.

Samuel (2021), Mena (2020), and Nawaz and Rehman (2017) explored the effects of peer tutoring in Mathematics across different educational levels. Samuel (2021) focused on Grade V pupils, Mena (2020) examined first-year college engineering students, while Nawaz and Rehman (2017) investigated secondary high school students. Despite the differences in their participants, all studies concluded that peer tutoring significantly improved students' performance in Mathematics. This strategy proved particularly effective in enhancing the academic achievement of weak and mediocre learners. These findings suggest that peer tutoring is a promising teaching method for fostering academic success in Mathematics across diverse educational contexts.

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Abdulkarim et al. (2022) examined the effect of the reciprocal peer tutoring strategy on Grade 8 students' Mathematics performance in learning rational algebraic expressions at Guindulungan National High School. There were forty (40) Grade 8 students who were randomly selected as the subjects of the study. The results revealed that there is a significant increase in the students' mathematics performance in learning rational algebraic expressions using reciprocal peer tutoring strategy. This implies that reciprocal peer tutoring strategy is effective in increasing students' mathematics performance. Similarly, Ycong et al. (2021) carried out a quasi-experimental design by studying about the Effects of Peer Tutoring to The Learning Outcomes in Exponential Expressions of Grade 8 Students. The study discovered that the peer tutoring strategy significantly improved the learning outcomes of students in the experimental group. It is recommended that peer tutoring strategy may be used by mathematics teachers to improve their students' performance in the subject matter. In a related study, Roy and Verma (2020) conducted a study examining the effectiveness of peer assisted learning strategy, a peer mediated instructional method in solving mathematical word problems by standard IV students in a general classroom and found that the Peer Assisted Learning Strategy (PALS) significantly improved students' scores compared to the control group in solving mathematical word problems, suggesting that peer-assisted learning is beneficial for solving mathematical problems.

In addition to these academic improvements, the role of peer tutoring in influencing students' cognitive domains and self-efficacy was also explored in several studies. In another peer tutoring study by Ullah, Kaleem, and Aamir (2020), the researchers investigated the impact of peer tutoring on the academic achievements of both tutors and tutees at the secondary level, specifically focusing on the cognitive domain's key levels (knowledge, comprehension and application) of the cognitive domain. The study explored data from 40 purposefully selected participants of ANSI school Mardan, by applying the Pretest Posttest Equivalent Group Design and conducting achievement tests before and after the treatments in order to accomplish the target objectives through inferential statistics (t-test) confirmed that though the tutors of the experimental group achieved better score at knowledge and application levels of the cognitive domain; however, they were not better in the comprehension level on post-test in compare to the high achievers of the control group. In the same way, the performance of the tutees of the group under investigation was significantly better with regard to academic ability, knowledge and comprehension at cognitive domain; however, at the application level, there was no significant difference as compared to their corresponding low achievers of the controlled group. In the light of the findings, it was concluded that the academic

performance of the tutors as well as the tutees was significantly affected by peer tutoring.

While peer tutoring helps improve academic performance and cognitive understanding, it also plays a crucial role in enhancing students' self-efficacy, as they gain confidence in their ability to solve problems and achieve academic success. Firdaus, Budiningsih, and Fauziah (2021) worked on the research about the effect of using peer tutor methods and self-efficacy on math learning outcomes with the aims to identify the implementation of a peer-tutor method and self-efficacy towards the students' mathematics learning outcomes. his research highlights several conclusions: a) learning method (external factor) and self-efficacy (internal factor) influence the students' learning outcomes; b) students taught with the peer-tutor method have better learning outcomes score compared to those taught with lecture method; c) there is an interaction between learning method and self-efficacy towards students' learning outcomes; d) for students with high self-efficacy, peer-tutor method results in better learning outcomes compared to lecture method; e) for students with low self-efficacy, the learning outcomes of students taught with peer-tutor method and lecture method are similar; f) in sciences subjects such as mathematics, peer-tutor method is recommended due to its capability of increasing the students' learning motivation, creativity, and self-efficacy. Overall, peer tutoring will in turn enhance their learning outcomes score. He stresses also that there is an interaction between self-efficacy and learning methods on mathematics learning outcomes; this implies that different learning methods will result in different learning outcomes. That said, the teachers must pay attention to the learning method; a proper learning method must adjust to the characteristics of students, learning material, and learning facilities.

The impact of peer tutoring on problem-solving skills was highlighted in a study conducted by Jucoy and Maglipong (2018), where the Grade 8 students were exposed to peer tutoring using the Math Pen Mate approach. Based on the findings, the researcher concluded that both groups showed improvement in their achievement test in Grade 8 Mathematics. The achievement test score and problem-solving skills of the tutor and tutees are comparable. The Peer Tutoring-Math Pen Mate positively influenced students' achievement test scores and an effective method in improving students' problem-solving skills.

Similarly, Awinoouko (2018) examined the role of peer instruction in improving students' perceptions of their problem-solving abilities in mathematics. The study involved 300 participants, including students from boys' schools, girls' schools, and co-educational schools, selected through proportionate sampling. Using an Ex Post Facto research design, the study collected data through questionnaires, and both descriptive and inferential statistics were applied in the analysis. The results indicate that majority of the students felt

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more confident in their ability to solve mathematics problems after receiving peer instruction. Based on these findings, the study recommends incorporating peer instruction into teaching strategies to help students develop better problem-solving skills in mathematics.

Even the slow learners are benefited from peer tutoring as revealed from the study of Lazarus (2015) which showed that there was a significant main effect of treatment on the mathematics achievement of students with learning disabilities. In other words, peer tutoring improves mathematics performance of students at risk or experiencing mathematics disabilities. It is therefore authenticating the finding that peer tutoring can be successfully implemented with tutors of various ability levels, including children with advanced skills and children with learning disabilities. Additionally, Bowman-Perrot et al. (2013) conducted a meta-analysis on the effect of peer tutoring across 26 single-case research experiments for 938 students in Grades 1 – 12. The findings were that peer teaching is an effective intervention regardless of dosage, grade level or disability status.

In the study conducted by Batool, et al. (2021) and Deluao (2018) analyzed the impact of peer tutoring on the mathematics performance of slow learners. Both studies found that exposure to peer tutoring significantly improved the mathematical performance of slow learners. Additionally, the students demonstrated increased cooperation with their peers and their confidence level was uplifted to a larger extent. During the peer tutoring sessions, it was observed that the slow learner students learned more quickly than the traditional method of teaching. The environment fostered by peer tutoring encouraged students to ask questions freely without hesitation, a behavior they were less likely to exhibit with their teachers. The findings of these studies highlight the transformative potential of peer tutoring. Not only does it serve as a catalyst for improved academic performance, but it also empowers educators by providing an effective strategy to address the learning challenges faced by slow learners in mathematics.

Another study involving slow learners was conducted by Etsu and Manko (2019) who explored the effects of a mathematics peer tutoring strategy on the geometry achievement of slow learners among junior secondary school students. Using a quasi-experimental design, the study provided strong evidence that the Peer Tutoring Strategy is an effective teaching method for improving performance in geometry compared to conventional teaching methods. The results suggest that this strategy should be implemented in teaching slow learners in junior secondary schools for better academic improvements. Additionally, the study found no significant statistical difference in the performance of slow learners based on gender when taught using the Peer Tutoring Strategy.

In a similar study, Putranto et al. (2018) investigated the effectiveness of peer tutoring combined with Realistic Mathematics Education (REM) for grade 7 slow learners. REM is a teaching approach that connects mathematical concepts to real-life experiences and problems. The researchers administered pre-tests and post-tests, consisting of 10 questions with multiple-choice answers, to assess the students' conceptual understanding. The findings demonstrated that peer tutoring, when integrated with REM, effectively enhanced the understanding of slow learners in mathematics, highlighting the potential of this combined approach in supporting their learning.

Moreover, the benefits of peer tutoring extend beyond academic performance. According to responses from teachers and students, peer tutoring improves students' attitudes, motivation, self-esteem, social skills, teamwork, and discipline. Teachers report that peer tutoring enhances group work and leadership skills, while students note improvements in confidence, communication, and moral behavior (Oloo et al., 2016). Recent studies further affirm these findings. Sallah et al. (2023), discovered that participants exposed to the peer tutoring instructional approach achieved higher scores and exhibited notably superior performance compared to those who experienced the traditional talk and chalk teaching method. Moreover, it is also concluded that there is no influence of gender on mathematics achievement. This implies that both male and female students performed equally in achievement in mathematics. This suggests that peer tutoring is a gender-friendly teaching method that benefits both male and female students in mathematics. These findings align with research by Awofala and Agbolade (2023), Longjohn and Osila (2022), Nagra (2022), Ogoke et al. (2022), Abuda and Jaromay (2021), Rosdianwinata, Rifa'i, and Nasrullah (2019), Ullah (2018), AbdulRaheem et al. (2017), and Abdelkarim and Abuiyada (2016), who all found no significant gender-based differences in outcomes related to peer tutoring. Similarly, Candelaria (2023), Okenyi (2023), Danga (2022), and Abuda and Jaromay (2021); and, Faquir Irsyada (2019) also found out that there is an increased interest in mathematics, with no significant gender-based differences in outcomes however the participants are elementary pupils.

Peer tutoring has been found effective not only in enhancing academic achievement but also in addressing off-task behaviors among students. Almas et al. (2020) explored the impact of the peer instruction (PI) method on first-course mathematics education students' academic performance and attitudes. After using PI for approximately seven weeks, the study revealed a significant positive effect on students' achievement in introductory mathematics analysis. Most participants strongly agreed that PI positively impacted their peers' understanding by making learning more engaging and interactive, creating a conducive classroom atmosphere, and

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enhancing students' overall learning experience. In a similar study by Campit and Garin (2017), peer learning led to a significant improvement in students' attitudes toward mathematics at the Pangasinan State University - Bayambang Campus. Students exposed to peer learning showed a marked improvement in their attitude toward mathematics, while those in the conventional teaching group did not exhibit such changes. This highlights peer learning as an effective strategy in enhancing students' attitudes and engagement with mathematics.

Over the past few decades, many meta-analyses and literature reviews on peer tutoring have been conducted, with some specifically focusing on peer tutoring in mathematics. Although there is a lot of current research on mathematics peer tutoring, its practical implications for secondary school education have not been fully explored. Active learning strategies, which allow students to engage in the learning process, are particularly recommended in this context (Zhao and Ding, 2019). However, there is limited research on how peer tutoring works in different types of schools, especially in non-Western countries such as Philippines or for students who are struggling.

Based on the studies mentioned, peer tutoring can help teachers, parents, students, and curriculum developers. Research shows it is an effective way to improve learning and close gaps in understanding. Peer tutoring not only helps students, but also supports teachers by encouraging teamwork in learning. It makes students feel more comfortable, reduces anxiety, and builds confidence, interest, and motivation. It also helps students grow socially and emotionally, communicate better with others, and improve their problem-solving skills. Despite these benefits, more research is needed to understand how peer tutoring affects students' academic performance, especially in secondary school mathematics. This study aims to fill this gap by examining how peer tutoring impacts the academic achievement of grade 10 students in junior high school.

METHODS

This chapter presents the methodology applied in the conduct of this study and the discussion of the research design; research site and participants, research population, sample size and sampling methods, research instrument, data gathering procedure, data analysis and ethical considerations

Research Design

The research design used in this study was the quasi-experimental design to investigate the effects of peer tutoring on students' academic achievement in learning mathematics aiming at improving academic achievement among grade 10 students with grades 79 and below. Zeneli, Thurston and Roseth (2016) have recently studied the influence of the experimental design on the academic performance in tutoring interventions. According to them, a

control group is necessary as its omission could produce an overestimation of the students' performance during this type of implementation. Therefore, as a control group is highly recommended, an experimental pretest post-test with a control group design was used in this study. Hence, two groups are formed in this design: The first group was exposed to peer tutoring (experiment) and the second group was given traditional lecture methods (control). In addition to that, this design was employed to determine the significant difference in students' achievement between the traditional or lecture and peer tutoring groups in learning Mathematics by gathering data on the homogenous group that will undergo a pre-examination or initial test and a post-examination or final test, both containing mathematical concepts and exercises.

Study Site and Participants

University of La Salette High School Department is a Catholic school that offers Junior High School Grade 7-10 and Senior High School comprising STEM, ABM and HUMMS strands. The school is located at Malvar, Santiago City Philippines for Junior High School and the Senior high school is located at Dubinan East Santiago city. The school was established in 1953 and has been offering quality education for 71 years now. In addition to that, the school is the first university in the region and has been accredited by PAASCU (Philippine Accrediting Association of Schools, Colleges and Universities) for several years and last February 9-10, 2023. They were visited and again granted LEVEL-II clean slate for 5 years. The school is also known to be a constant producer of champions, an institution of effective learning, providing a quality education and promoting the growth and development of the students in consonance with the national growth towards quality education.

Population, Sample Size and Sampling Methods

The participants of the study are the Grade 10 students of University of La Salette Incorporated High School, which currently has 298 students in this grade level. This study used purposive sampling and simple random sampling. The selection of the participant was done by purposive sampling, while simple random sampling was used for assigning the participants to either control or experimental. The target participants for this study includes students who scored between 79% and below in their 2nd-quarter Mathematics grades, identified by the mathematics teacher. Initially, 66 students met this criterion, but due to transfers and withdrawals, 60 students remained eligible for participation who were randomly assigned to either the experimental or control group. The group was divided into two; 30 (thirty) of the students were assigned to the control group (taught the traditional/ conventional way). Meanwhile, the remaining (30) thirty students belonged to the experimental group (exposed to peer tutoring). The mathematics teacher in charge was the one who assigned the students to control or experiment by simple random sampling

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or fishbowl technique, by putting their names into a box, mixing them thoroughly and picking names. The first 30 names were assigned to the experimental group, which would receive peer tutoring, while the remaining 30 students formed the control group, which would receive traditional lecture-based instruction.

Additionally, 30 students with grades of 90% and above in their 2nd-quarter Mathematics were chosen as peer tutors for the experimental group. These tutors were trained to facilitate the peer tutoring sessions, providing one-on-one support to their peers who were academically challenged in Mathematics.

Research Instruments

The main instrument used in this study is a researcher made Mathematics Achievement Test (MAT). The test consists of 60 items, all multiple-choice questions having four options with one correct answer from the Grade 10 3rd quarter lesson in Mathematics competencies as stipulated in the K to 12 Mathematics Basic Education Curriculum. The validity of the test was checked by five experts who took deep analysis of items of questions. They provided feedback on the clarity of the questions, ensuring that they accurately assessed the intended concepts. The researcher consolidated the comments/suggestions and then edited, refined and finalized it in line with the changes suggested by the panel of experts. The researcher also constructed a table of specifications (TOS) that serves as the test blueprint in constructing the instrument to ensure representativeness of subject matter. The TOS (Table of Specification) was based on the new Blooms of taxonomy which consists of knowledge understanding, applying and analyzing, evaluating and creating. The distribution of percentage of each category was adopted and based on the institution of the study. The researchers conducted a pilot testing at St. John Berchman High School at Cordon Isabela. The reliability of the test was calculated using the Kuder-Richardson Formula 20 (KR-20), which yielded a reliability coefficient of 0.7912, indicating that the instrument is reliable for measuring student achievement.

Data Gathering Procedure

Before conducting the study, the researcher obtained permission from the principal to conduct the study. The researcher asked the Grade 10 Mathematics teacher in charge in the school to identify the potential participants — students with 79 % and below during the second quarter. The researcher also asked the teacher in charge to identify and assign the students randomly into experimental and control groups. In order to know who will be assigned to be the participant for the experimental group, the teacher in charge put the names of the participants in a box, shuffled and then the teacher picks names. The first 30 names were the experimental group and the remaining names in the box were the control group. The researcher then met with the students

in the experimental group to explain the nature, purpose, and duration of the study. After obtaining their consent, an orientation session was held to inform them about the expectations, guidelines, and the dos and don'ts for the peer tutoring sessions.

For the experimental group, students who scored 90% or higher in their 2nd-quarter Mathematics grades were chosen as peer tutors. These tutors were paired with students who had grades of 79% and below to form one-on-one tutoring pairs. Tutors are given proper instruction and training to ensure that peer tutors are prepared for every session. The contents of the tutoring sessions were discussed one day earlier to the tutors by the same instructor, who also taught the control group. They are instructed on how interactions should be during the sessions. The peer tutors are given a lesson plan with learning activities and they are guided on how to use the lesson plans and PowerPoint, throughout the five weeks. These lesson plans served as a guide for conducting or delivering lessons to the control and experimental groups. Both the experimental and control groups were provided with the same study materials, including worksheets with exercises. The complexity of the exercises and problems varied according to the worksheet. Extra activities were prepared in case some pairs finished the worksheet much earlier than the rest of the class. Tutees are also free to ask questions and answer the problems given at their own pace. Additional facilitations were provided by the researcher who was overseeing the whole activities during the program. The pairing was done at random by drawing lots. Each student's name was written on a piece of paper then rolled and put it in a box. Then the teacher draws two rolled papers at a time. This composed a pair. The same process was done until all the rolled papers had been drawn.

The researcher was the one who implemented the peer tutoring sessions. The researcher monitored, supervised, and facilitated the peer tutoring session. The researcher monitored students' interactions during the tutoring time to ensure that students were addressing mathematics contents instead of other academic or non-academic issues. Besides, the researcher ensured that there are no behavioral problems between any pair of students. The experiment was conducted for one hour for five weeks during the ICL (Interactive Cooperative Learning) period only. The five-week program with one-hour sessions was based on the study by Alegre et al. (2019). Their research showed that shorter programs with structured sessions work well in improving students' performance in math. Their study found that programs longer than eight weeks or sessions longer than 30 minutes had smaller effects. This is why the researcher chose a shorter program with focused sessions. At the conclusion of the five weeks, after all the topics to be covered, post-test was given to both the control and the experimental group to assess the learning of the students and to measure and assess the effectiveness of peer tutoring. The post-test was just similar

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to the pre-test. The result of the post-test was recorded and compared with the results of the pre-test to see if there is an increase in the scores of the students to determine the effect of the intervention in the achievement of the students in Mathematics.

Data Analysis

After the administration of the instruments, the researcher recorded the results and use the following statistical tools:

1. Mean and Standard Deviation was used to determine the pre-test and post-test mean scores of the students using the peer tutoring to describe the average entry knowledge of the learners prior to the administration of the peer tutoring to the experimental group of learners and also to describe the average performance of the learners in both groups after administering of the peer tutoring as well as to determine the variability of scores from the mean.

2. Paired samples t-test to determine whether there is a significant difference between pre-test and post-test scores within each group. Students' t-tests (95% confidence level) were used to analyze the differences in the pretest scores between the control group and the experimental group.

3. Independent t-test was used to determine if there is a statistically significant difference between their scores on both pre-test and post-test.

4. Cohens D. was used to calculate the effect size of the peer tutoring on the academic achievement of the participants.

Ethical Considerations

The researcher adhered to ethical guidelines throughout the study to ensure the protection of participants' rights and well-being. First, informed consent was obtained from both

the school administration and the parents of the students, as the study involved minors. A consent form was provided to the students, which outlined the study's purpose, procedures, and potential risks. Participation in this research is voluntary and participants were not forced to participate. The researcher respects the right of the participants if ever they wish to withdraw from participating at any time. The researcher ensured that there would be no negative impact on the participants' academic standing or personal relationship with the school as a result of withdrawal. If any conflicts or issues arose during the study, such as behavioral problems or interpersonal difficulties between students, the researcher was prepared to address these issues promptly. The study also ensures the confidentiality and anonymity of the participants by not disclosing their personal information and school details to any third party.

The intervention used in the study was designed to enhance learning achievement and posed no physical, psychological, or emotional harm to the students. The researcher made sure that the intervention remained beneficial and supportive for all participants, ensuring that it did not create undue stress or pressure. The researchers conducted the research in a manner that respected the rights and well-being of all participants involved, no biases involved and no incentives were given to the participants for their involvement in the study.

RESULTS

Part 1. Pre-test and Post-test Scores of the Participants

Table 1 presents information about the achievement of the students exposed to peer tutoring and conventional teaching group.

Table 1. Descriptive statistics of Pre-test and Post-test Scores of the two Groups

Control	Pre-Test			Post-test		
	N	Mean	SD	Mean	SD	MD
Experimental	30	20.2	4.74	22.6	6.13	2.4
	30	21.1	4.88	29.3	6.73	8.2

Note: N = Sample Size, M = Mean, SD = Standard Deviation, MD = Mean Difference

The data in Table 1 provides a detailed comparison of the outcomes observed between the experimental group, where students are exposed to peer tutoring, and the control group, where students exposed to the traditional talk and chalk method. It shows that the pre-test score of students taught mathematics using conventional teaching method was (M=20.2, SD = 4.74) and their post-test mean score was (M=22.6, SD = 6.13) showing a mean difference of 2.4. While, In the experimental group wherein the students were exposed to peer tutoring, their pre-test score was (M= 21.1, SD = 4.88)

and their post-test score was (M= 29.3, SD = 6.73), indicating a mean difference of 8.2. Moreover, the value of standard deviation indicates that the control group showed less variation as compared to experimental group. This implies that both groups demonstrated improvements from their pre-test mean scores to their post-test mean scores. However, the substantial mean difference of 8.2 recorded by the experimental group students exposed to peer tutoring suggests a more substantial improvement compared to the control group taught using the talk and chalk method. This

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shows that students exposed to peer tutoring performed better than those exposed to the conventional method. To find out if the difference in means was statistically significant, the corresponding hypothesis was therefore tested (Table 2-5).

Hypothesis Testing before T-Test, homogeneity test was employed to test whether or not the research samples have homogenous variance and a normality test was also conducted to test the distribution of the population. The Levene homogeneity test result was the p-value is .859 which shows that the samples are homogenous, while the Shapiro

wilk test result resulted to $p=.316$ indicates a normally distributed population.

Part 2. Difference between the Scores of the Participants under Control and Experimental Group

2.1. Pre-Test Scores

Table 2 shows the significant difference between the scores of the participants under control and experimental group in terms of their pre-test.

Table 2. Independent Samples T-Test for control and experimental group pre-test

	N	Mean	SD	Statistic	Df	P	Interpretation	Decision
Control	30	20.2	4.74	-0.698	58.0	0.488	Not significant	Accept H_0
Experimental	30	21.1	4.88					

Note. $H_a \mu_{Control} \neq \mu_{Experimental}$

Table 2 demonstrates the results of an independent-samples t-test that was applied to match the overall mean score of experimental and control group with respect to pre-test. In the control group, the mean score and standard deviation were calculated as ($M = 20.2$, $SD = 4.74$), whereas for the experimental group, these values were recorded as ($M = 21.1$, $SD = 4.88$). The statistical analysis, performed at a significance level of 0.05, revealed an observed condition of [$t(58) = -.698$, $P = 0.488$]. Upon closer scrutiny of the results, the computed p-value of 0.488 exceeded the predefined significance level of 0.05. This means that the null hypothesis

is accepted and that there is no significant difference between the mean scores of the participants in the experimental and control group. This implies that that the pre-test means scores of the students assigned to experimental and control groups are almost the same before the administration of the intervention

2.2 Post-Test

Table 3 shows the significant difference between the scores of the participants under control and experimental group in terms of post-test.

Table 3. Independent Samples T-Test for Control and Experimental Group Post-test

Group	N	Mean	SD	Statistic	Df	p	Interpretation	Decision
Control	30	22.6	6.13	-4.01	58	<.001	Significant	Reject H_0
Experimental	30	29.3	6.73					

Note. $H_a \mu_{Control} \neq \mu_{Experimental}$

Table 3 displays results of an independent-samples t-test that was applied to compare the overall mean score of experimental and control group with respect to post-test. In the control group, the mean score and standard deviation were recorded as ($M = 22.6$, $SD = 6.13$), while the corresponding figures for the control group were ($M = 29.3$, $SD = 6.73$). The statistical analysis, conducted at a significance level of 0.05, resulted in an observed condition of [$t(58) = -4.01$, $P < .001$]. Upon closer examination of the results, the calculated p-value of 0.001 is lower than the 0.05 level of significance. This is interpreted that both groups are not equal in academic

achievement at the end of interventions and that there is a significance difference in their academic achievement. This outcome underscores that a substantial difference indeed existed in the achievement of students who were exposed to peer tutoring in comparison to their counterparts taught through the talk and chalk method. In simpler terms, the experimental group, displayed significantly superior achievement compared to the control group.

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Part 3. Difference between the Scores of the Participants under Control and Experimental Group

3.1 Pre-test and Post-test of Control Group

Table 4 shows the difference between the pretest and the posttest mean scores of the control group.

Table 4. Paired Sample T-test for Control Group with respect to Pre-test and Post- test

Group	N	Mean	SD	Statistic	Df	P	Interpretation	Decision
Pre-test	30	20.2	4.74	-2.64	29	0.013	Significant	Reject H ₀
Post-test	30	22.6	6.13					
Cohens d = .482 : small size								

Note. H_a μ Measure 1 - Measure 2 \neq 0

In order to assess the first hypothesis a paired-samples t-test at significance level of 0.05 was used. The goal was to compare the significant difference between the pre-test and the post-test mean scores of the control group. Table 4 revealed that there was a significant difference in the pre-test scores of the control group (M=20.2, SD=4.74) and post-test scores (M=22.6, SD=6.13) of the control group. Since, the absolute value of the calculated t-statistic (-2.640) is greater than the critical t-value (2.045) and the p-value (0.013) is less than 0.05, hence, the null hypothesis is rejected. These results revealed that there is an increase in the academic achievement of students. However, in addition to the finding above, Cohen’s d was also computed to determine the magnitude of the effect of traditional teaching. The calculated effect size was .482 which is

considered as small effect size. This implies that while it’s true that there is a significant difference between the pre-test and post-test scores of the participants, the Cohen’s d suggests that traditional method has a small impact on students’ achievement. This further suggests that the traditional method of teaching cannot be completely replaced and that there is still benefit from using the traditional method. This finding suggests that the students need to be exposed to a new teaching strategy other than the traditional method to achieve better academic performance.

3.2 Pre-test and Post-test of Experimental Group

Table 5 shows the difference between the pre-test and the post-test mean scores of the experimental group.

Table 5. Paired Sample T-test for Experimental Group with respect to Pre-test and Post-test

Group	N	Mean	SD	Statistic	Df	P	Interpretation	Decision
Pre-test	30	21.1	4.88	-5.89	29	<.001	Significant	Reject H ₀
Post-test	30	29.3	6.63					
Cohens d = 1.07: large effect size								

Note. H_a μ Measure 1 - Measure 2 \neq 0

Table 5 indicates the Paired sample t test was used to evaluate the difference of achievement of participants before and after the implementation peer tutoring of experimental group. It is revealed in table 5 that there is a statistically significant difference between the mean scores of the pre-test (M=21.1, SD=4.88). the post-test mean score (M=29.3, SD=6.63) of the experimental group since the absolute value of the calculated t-statistic (-5.89) is greater than the critical t-value (2.045), and the p-value (<0.001) is significantly smaller than 0.05, thus, the null hypothesis is rejected. This reveals that that students’ achievement after the intervention have increased. Moreover, Cohen’s d was also computed to determine the magnitude of the effect of peer

tutoring in the achievement of the participants. The effect size obtained was 1.07 which is considered as a large effect size. These values suggest that peer tutoring has a significant large effect on students’ achievement in mathematics. This provided evidence that the peer tutoring is effective on improving student achievement in learning mathematics.

Part 4. The Effect Size of the Peer tutoring on the Academic Achievement of the Participants

Table 6 shows the effect size of the peer tutoring on the Academic Achievement of the Participants in learning Mathematics

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Table 6. Effect Size of the Peer tutoring on the Academic Achievement of the Participants in Mathematics

Effect Size	Interpretation
Cohens d= 1.07	Large Effect Size

Small Effect Size (0.2); Medium Effect Size (0.5); Large effect Size (0.8)

As shown in table 6, the experimental group yields Cohens d= 1.07 which is considered as large effect. This implies that peer tutoring has a large effect on the academic achievement of students in learning Mathematics and therefore peer tutoring is an effective intervention in enhancing the learners’ academic achievement in Mathematics.

Part 5. Proposed M.A.T.H. S.T.A.R.S. (Math Assistance Tutoring for Helping Salettinian’s Thrive and Achieve Remarkable Success)

I. Rationale

Mathematics still remains the most feared subject. This is true in spite of the many efforts exhausted by math educators, but this should not stop math teachers from exerting means and ways to allow students to befriend and be comfortable with Math. This is a big challenge for Math teachers hence, much thought was given regarding how complex processes can be simplified to meet the level of the students. As always and as it should be, what the learners can absorb with the utilization of interesting activities should be considered. With the complexity of the teaching world, a teacher must really become flexible and able to market himself in the need for fast phasing and immediate solution to problems in the field as they arise. They must not also be contented with his daily routine. In most instances, they must be a developer and a creator of opportunities for students to learn and further hone their skills as they explore the wider horizons.

University of La Salette High School promotes a Catholic quality education. The schools aim to develop the students holistically by inculcating them the required skills, competencies, and abilities needed to become functional in the society. Moreover, the school places a high value on promoting and assisting students who have difficulty in learning Mathematics. The school keep trying everything it can to help those who are in need in order to make sure that the students improve in learning and appreciate the subject. to attain this, there is a need to innovate strategies in teaching this learning area to make it motivating and easy to comprehend. Moreover, the researcher came up with the development and implementation of intervention programs titled M.A.T.H. S.T.A.R.S. (Math Assistance Tutoring for Helping Salettinians Thrive and Achieve Remarkable Success) this program promotes one on one peer tutoring where a skilled learner is partner to a struggling student. Peer to peer tutoring can lead to an increase in confidence for both students involved. A struggling student receives more individualized attention, as well as more feedback on their practice and efforts. As they try to instruct a classmate, the helping student becomes more assured that they grasp the content.

II. Objectives

The main objectives of the program are to improve students’ academic achievement in Mathematics. More particularly, it has the following objectives as follows:

- To provide support to students at risk of failing Mathematics in all grade levels and those who need to improve their numeracy skills;
- To overcome learning difficulties in Mathematics; and
- To develop among students the love and confident for Mathematics and help them overcome their frustration and fear of Mathematics resulting to decrease in failure.

III. Mechanics and Implementation

The following are the activities to be undertaken by the proponent during the pre-implementation phase to post implementation phase.

A. Pre-Implementation Stage

The following activities will be undertaken by the proponent:

1. Work out a plan with the people who will be in charge in the presentation and dissemination of the program. Define the roles and responsibilities for each stakeholder involved in the program.
2. Write a letter to the key people and include any other requirements;
3. Inform everyone especially those who will be needed and who are part of the program through announcements, online platforms and others.
4. Teachers will be identifying students (tutors and Tutees), inform their parents and ask their consent.

B. Implementation Stage

1. Conduct an orientation session for all students (tutors and tutees) to inform the about the goals of the program, guidelines for tutoring sessions, and expectations for both tutors and tutees. Moreover, provide training for students who will act as peer tutors to ensure they understand how to effectively support their peers.
2. Design activity worksheets needed for weekly sessions on the conduct of peer tutoring
3. Monitor the attendance of the students during the implementation of the program and provide ongoing support and guidance to tutors and tutees throughout the implementation of the program.

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4. Monitor the progress of tutoring sessions and address any challenges or issues that arise promptly.

C. Post Implementation Stage

1. Mathematics teachers, parents, and students will meet quarterly to discuss progress, address concerns, and provide updates on the intervention program's implementation

2. Regularly assess the impact of peer tutoring on student performance. Hold post-implementation meetings to gather feedback from students and parents on the effectiveness of the program.

3. Use feedback to identify strengths, weaknesses, and areas for improvement in the peer tutoring program.

4. Monitor and evaluate the academic progress of tutees through regular assessments and progress reports

IV. Workplan Activities

STAGES	OBJECTIVES	ACTIVITIES/ACTION STEPS	EXPECTED OUTPUT	TIME FRAME	MONITORING SYSTEM	PERSONS INVOLVED	BUDGET
Planning Stage	<p>1.to Identify the needs of the program</p> <p>2. to ensure clear understanding among stakeholders regarding the nature, scope, and schedule of the M.A.T.H. S.T.A.R.S. intervention program.</p>	<p>1. Conduct a meeting with Mathematics Teachers together with the coordinator to discuss the M.A.T.H. S.T.A.R.S. (Math Assistance Tutoring for Helping Salletinians Thrive and Achieve Remarkable Success) intervention program.</p> <p>2. Seek the approval of the project proposal of Mathematics Department head, School head and School President</p> <p>3. Identify names of students who will undergo peer tutoring (tutors and Tutees). Those students recommended by their math teacher will only the one to join the peer tutoring. Students who have grasped concepts at the mastery level which are also recommended by their math teacher re allowed to tutor other students and teach some lessons (math monitors)</p> <p>4. Parents will be informed of the need for their child/children to be a part of the intervention program. Letter of Consent /Agreement will be given to parents and collected with signature</p> <p>5. Create worksheets to be used in the peer tutoring sessions</p>	<p>1. Clear understanding among the Mathematics Teachers and the Coordinator about the goals, objectives, and implementation plan of the M.A.T.H. S.T.A.R.S. intervention program.</p> <p>2. Effectively identified program requirements and filed letters for the Program</p> <p>3. printed materials and resources for the tutoring sessions, including worksheets.</p>	August 2024	*minutes of the Meeting *Approved Letters of the Intervention Program	Department Head Math Teachers Math Club Officers	P 500

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Implementation Stage	<p>1. To orient parents and students about the program</p> <p>2. Orient as well the Peer tutors on the dos 'and don'ts during peer tutoring</p> <p>3. to Equip peer tutors with the necessary skills and knowledge to effectively support their peers through tutoring sessions</p>	<p>1. Conduct meetings with parents of the children involved in the program. Discuss the nature, scope, , rationale amd schedules of the M.A.T.H. S.T.A.R.S. (Math Assistance Tutoring for Helping Salletinians Thrive and Achieve Remarkable Success) intervention program. to students and parents for familiarity and to stimulate students love for numbers</p> <p>2. Conduct training sessions for peer tutors specifically on tutoring strategies, communication skills, and content of the lessons.</p>	<p>Oriented parents and students about the program</p> <p>- Trained and prepared peer tutors</p>	<p>1st week of September 2024</p>	<p>*Narrative Report</p> <p>*Documen tation</p>	<p>Department Head</p> <p>Math Teachers</p>	P 1000
	<p>1. To conduct a math tutorial for less mathematical literate learners by implementing M.A.T.H. S.T.A.R.S. (Math Assistance Tutoring for Helping Salletinians Thrive and Achieve Remarkable Success)</p>	<p>1. Print copies of Worksheets and be given to peer tutors ahead of time.</p> <p>2. Check and monitor the attendance of the students in every session</p> <p>3. Monitor behavior of the students during the peer tutoring sessions. The teachers in each grade level will supervise the sessions to provide support and ensure the quality of tutoring</p> <p>4. Assess student progress through quizzes, assignments.</p> <p>5. Schedule regular meeting with the tutors to solicit</p>	<p>1. Improved written output of the students</p> <p>2. Improved and increased Performance Level of the learners in Mathematics</p>	<p>Every ICL perid Starting 2nd week of September 2024- April 2025</p>	<p>*Narrative Report</p> <p>*document ations</p> <p>*logbook for the attendance of both tutors and tutees</p>	<p>Department Head</p> <p>Math Teachers</p> <p>Peer tutors</p> <p>Math Club officers</p>	P 2000

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	2. To upgrade students' mathematical abilities	feedback on their experiences with the program and at the same time assess its overall effectiveness and identify areas for improvement.					
	3. Monitor student progress	6. Provide regular progress reports to both students and parents to keep them informed about their academic progress, areas of improvement, and achievements.					
Post Implementation Stage	1. to identify strengths, weaknesses, and areas for improvement in the peer tutoring program.	1.Evaluate and analyze the effectiveness of the program using survey and feedback forms both the tutors and tutee. the surveyed forms 2.Prepare a detailed report on the program's outcomes and present it to school administration	1.Success of the program is accurately monitored and evaluated 2. Formal report documenting the impact of the tutoring program.	April 2025	Results of the survey and feedback of tutors and tutees	Department Head Math Teachers Peer tutors Math Club officers	P 1000

DISCUSSION

The present study aimed to investigate the effect of peer tutoring on the academic achievement of students in mathematics. A quasi-experimental design was employed, dividing participants into an experimental group, which received peer tutoring, and a control group, which followed traditional teaching methods. A self-devised tool was used to evaluate mathematics achievement of the participants. For analyzing the performance difference, pre-test and post-test were used using independent t-tests and paired sample t-tests.

Part 1. Pre-test and Post-test Scores of the Participants

The results revealed that the mean pre-test scores for the experimental group and the control group were 21.1 and 20.2, respectively. After the intervention, the mean post-test scores increased to 29.3 for the experimental group and 22.6 for the control group. This indicates that the experimental group, which was exposed to peer tutoring, had a mean gain of 8.2, while the control group, taught using the traditional chalk-and-talk method, had a mean gain of 2.4. These findings suggest that students exposed to peer tutoring demonstrate the significantly greater improvement in mathematics achievement among students who participated in peer tutoring compared to those who did not.

The study's findings align with other researches on peer tutoring in mathematics, demonstrating its positive impact on students' academic performance. Annaz (2017) and Candelaria (2023) found that peer tutoring improves

academic achievement, particularly for students struggling with mathematics. Similarly, Berso (2020) and Ycong & Mamolo (2021) suggest that peer tutoring can help in the cognitive capacities of students. They made mention that students who underwent peer tutoring sessions improved exam performance compared to those exposed to conventional teaching strategies. Oslo et al. (2016) noted that 92.6% of students agreed their math grades improved due to peer tutoring. Abdellkarim and Abuiyada (2016) emphasized that their findings support the idea that peer tutoring effectively enhances mathematical achievement that the experimental group delivered better score after having being engaged in peer tutoring in contrast to the control group. Similarly, Etsu and Manko (2019) discovered that peer tutoring benefits slow learners in secondary school geometry. Asempapa et al. (2021) concluded that peer tutoring aids both fast and slow learners. Finally, Longjoh & Osila (2022) indicated that students perform better in math when taught interactively by peers compared to traditional methods

Part 2. Differences in Mean Scores Between the Control and Experimental Groups

The study investigated the differences in mathematics achievement between students in the control group (traditional teaching) and the experimental group (peer tutoring). The pre-test analysis showed no significant difference in the mean scores of the control and experimental groups. This suggests that the two groups had similar levels

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of prior knowledge and skills in mathematics before the intervention. his finding is similar to the studies by Aftab et al. (2022) and Odutayo and Yusuf (2020), which also found that students in their groups had similar academic levels before being taught differently. Having comparable groups is important because it ensures a fair comparison of the post-test results to see how peer tutoring affected students' math performance.

After the intervention, the post-test analysis revealed a significant difference in the academic performance of the two groups. Students in the experimental group, who experienced peer tutoring, performed much better than those in the control group, who were taught through traditional methods. This shows that peer tutoring is an effective way to improve math achievement. These findings agree with the study by Abdellkarim and Abuiyada (2016), which also found that students in peer tutoring programs scored higher than those taught in traditional ways. Similarly, Ogoke et al. (2022) showed that peer tutoring is a better teaching method for helping students succeed in math. One reason for this, as explained by Deshler et al. (2019), is that students in peer tutoring feel more comfortable asking their peers questions. This allows the peer tutors to give clear and direct explanations, helping the students understand the lessons better.

Part 3. Differences Between Pre-test and Post-test Mean Scores within the Control and Experimental Groups

This study looked at the differences between the pre-test and post-test scores of the experimental group and control group. A paired-samples t-test showed a significant increase in the control group's post-test scores compared to their pre-test scores. This indicates that students experienced some improvement in their academic achievement after being taught using the traditional method. However, the calculated effect size (Cohen's $d = 0.482$) suggests that the impact of traditional teaching was small. This means that while the traditional teaching method helped, its impact was not very strong. This suggests that relying only on traditional teaching may not be enough for students to achieve significant progress. To help students perform better, new teaching strategies should be used alongside the traditional method. These findings match studies by Letam (2022), Danga (2022), and Kibuthu (2016), which also found differences between pre-test and post-test scores in control and experimental groups. Danga (2022) noted that even without strategies like peer tutoring, students can still perform well with traditional teaching. However, Zeneli et al. (2016) found that traditional teaching often leads to only small to medium improvements, limiting its overall impact.

For the experimental group, the study also looked at the difference between their pre-test and post-test scores to see how peer tutoring affected their performance. The results showed a significant improvement in their scores after the

peer tutoring sessions, proving that this method had a strong positive impact on their math achievement. The effect size (Cohen's $d = 1.07$) shows that the improvement in the experimental group was very large. This means peer tutoring is a highly effective way to help students perform better in math. It shows that peer tutoring not only boosts students' scores but also has a big impact on their understanding and learning. The results show that peer tutoring programs can be very effective in improving math performance (Ycong, Barredo, & Mamolo, 2021). This finding is supported by Ullah and Kaleem (2020) who found that peer tutoring helps both tutors and tutees improve academically and develop intellectually. Chiew et al. (2021) also reported that peer tutoring is a successful method for helping students with weaker academic performance. It not only improves their performance but also helps reduce failure rates. Similarly, Moliner and Alegre (2020a) and Ullah et al. (2018) confirmed that peer tutoring has a positive effect on student achievement.

While both groups showed improvement, peer tutoring had a much bigger and more meaningful effect on student performance. This supports the findings of Danga (2022) and Chiew (2021), who also found that peer tutoring leads to significant academic gains, with large effect sizes like 1.62. These studies confirm that peer tutoring is a highly effective teaching method. This suggests that the students are need to be exposed to peer tutoring to achieve better academic performance.

Part 4. The Effect Size of the Peer tutoring on the Academic Achievement of the Participants

The experimental group achieved a Cohen's d value of 1.07 which is considered a large effect. This means that peer tutoring had a strong positive impact on students' academic performance in mathematics. Overall, peer tutoring has been proven to be beneficial. The findings suggest that exposing students to peer tutoring in mathematics is an effective strategy for academic improvement and student success.

CONCLUSION

From the findings presented and discussed, the researcher concluded the following:

1. Both group control and experimental group demonstrated improvements from their pre-test scores to their post-test scores. However, the experimental group, exposed to peer tutoring suggests a more substantial improvement compared to the control group taught using the talk and chalk method. The promising improvement in scores of low achiever students in experimental group showed that peer tutoring is effective. The said finding gives an inference that learners can gain better achievement when exposed to peer tutoring.

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2. There is no significant difference in the overall mean score of experimental and control group with respect to pre-test which means that the two groups have the same performance level prior the intervention. On the other hand, there is a significant difference in the overall mean score of experimental and control group with respect to post-test in favor to peer tutoring. This is interpreted that both groups are not equal in academic achievement at the end of interventions and that there is a significance difference in their academic achievement. In simpler terms, the experimental group, displayed significantly superior performance compared to the control group.

3. There is a significant difference between the pre-test and post-test mean scores of both groups, the control and experimental group. This suggests that the traditional method of teaching cannot be completely replaced and that there is still benefit from using this method. However, since there is a large effect of the academic achievement on experimental group compared to the control group. This implies that peer tutoring displayed significantly improvement achievement compared to the control group as revealed by the computed effect size of this group. While traditional teaching led to some improvement, peer tutoring was far more effective in boosting students' math performance. Using peer tutoring can give students a better chance to improve and achieve greater success in learning mathematics.

4. The effect size of peer tutoring indicates a large effect. This implies that peer tutoring has a large effect on students' academic achievement in mathematics. Therefore, peer tutoring is an effective intervention in enhancing the learners' academic achievement in Mathematics.

RECOMMENDATION

The following recommendations are enlisted on the basis of conclusions:

1. Since peer tutoring have a high effect to the academic achievement of students. The researcher strongly advocate for mathematics educators to embrace peer tutoring as an intervention program, particularly for struggling learners. This approach can enhance students' academic achievement, improve their performance, and help them develop confidence in mathematics.

2. School Administrator should encourage mathematics teachers to have an intervention like peer tutoring particularly to the struggling learners who need to have an extra time, effort and attention from the teachers to improve their achievement and performance in school.

3. The findings revealed that peer tutoring promotes academic achievement. Hence, curriculum developer are encouraged to incorporate peer tutoring activities into the mathematics curriculum. It is further recommended that during classroom instruction, students of low academic performance may be paired with students of good

performance for long sessions so that the formers are guided and tutored properly.

4. Seminars, conferences, and workshops should be organized for teachers. This would help improve their knowledge and skills of peer tutoring strategies to achieve effective implementations.

5. Students are encouraged to take initiative in learning and be positive in identifying areas where they need help and seek out peer tutors for assistance and approach peer tutoring with an open mind and a willingness to learn. The students are also encouraged to consistently or regularly attend and be active in their peer tutoring sessions as it helps them understand their lesson better and perform better academically.

6. The school should engage parents in the peer tutoring process by informing them about the benefits that their children could gain from it. Their role is a great help in the implementation of the peer tutoring as they can provide additional motivation and reinforcement at home.

7. Future research should be conducted with larger and more diverse sample sizes to validate the findings of this study. Investigate the long-term effects of peer tutoring on academic achievement and other subject areas beyond mathematics. Explore the effectiveness of peer tutoring in diverse educational settings and among different student populations to understand its broader applicability. Moreover, other techniques that help students perform better in mathematics should be explored.

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