

Effect of Roblox math games on numeracy skills of struggling Grade 9 students

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ABSTRACT

This true-experimental research design investigated the effect of using Roblox Math game application and conventional teaching strategy in teaching mathematics on the Numeracy Skills of Grade 9 struggling learners of Nicomedes R. Tubar Sr. National High School for school year 2025 – 2026. The participants of this study were the seventy-nine (79) struggling students of Nicomedes R. Tubar Sr. National High School, for the school year 2025-2026. The data in this study was gathered using a 53-item researcher-made Mathematics numeracy skills test to measure the numeracy skills of the Grade 9 struggling students. The descriptive statistics used in the study were the mean, standard deviation, and Cohen's d to summarize the data. Moreover, for inferential statistical tools, the t-test for independent and dependent samples was used. The alpha level of significance was set at 0.05. Based on the results, the major findings of the study were the following: The numeracy skills of Grade 9 learners in the pretests of both the control and the experimental group were "very low". While after the intervention, students in the experimental group had "very high" numeracy skills and the control group was "high". There was no significant difference in the numeracy skills of Grade 9 struggling learners in the pretests of the control and experimental groups. There was a significant difference in the problem numeracy skills of Grade 9 struggling learners in the pretests and posttests of the control and the experimental groups. There was a significant difference in the numeracy skills of Grade 9 struggling learners in the posttests of the control and experimental groups. There is a significant difference in the numeracy skills of Grade 9 struggling learners in the pretests and posttests of the control and the experimental groups. There was a significant difference in the numeracy skills of Grade 9 struggling learners in the posttests of the control and experimental groups. The effect size of Roblox Math game application in the numeracy skills of Grade 9 struggling learners was large.

Keywords: Roblox math game, numeracy skills, struggling learners, true-experimental research, mathematics education.

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INTRODUCTION

Poor numeracy skills or knowledge of numbers and math, means that success will be limited. This will lead to difficulty of discission making. This also means that students will find it harder to predict cause and effect in a problem-solving situation. Knowing the starting

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number, ending number and the difference helps students to learn the idea of cause and effect (Thompson, 2022).

Research, such as the Programme for International Student Assessment (PISA, 2012), has reported notable gender-based differences in mathematics-related affective constructs, including anxiety, self-efficacy, and self-concept. In line with these findings, O’Keeffe et al., (2018) investigated these factors among Year 7 and 8 students in South Australia to determine whether such disparities persist. Their results revealed that mathematics anxiety remains dominant among students at these levels, with significant gender-based differences evident in both self-efficacy and anxiety. These findings highlight the ongoing importance of addressing affective dimensions of learning to support students’ confidence and engagement in mathematics.

According to Annual Status of Education Report (ASER) in rural area of India, many students struggle with simple division problem. This implies that, a lack of numeracy skills and proficiency in basic operation like division can severely hinder the ability to understand and perform more advanced mathematical task. Low levels of foundational numeracy affect the ability of students in everyday calculations (ASER Centre, updated 2024).

Also, according to the latest results from the Trends in International Mathematics and Science Study (TIMSS, 2023) released by the National Center for Education Statistics, the mathematics scores of U.S. fourth and eighth graders declined on international mathematics and science assessment, this denotes that learners are having difficulty in answering basic mathematics operations and could not able to understand mathematical concepts or getting hard time to perform. (NCES.<https://nces.ed.gov/timss/>retrieved Sept 25,2025).

Based on the Functional Literacy, Education, and Mass Media Survey (FLEMMS,2024) revealed that about 18 to 19 million high school graduates do not meet updated standards that include comprehension and numeracy skills in real-life situations. The recent revelation by the Philippine Statistics Authority (PSA, 2024) that nearly 19 million Filipinos who finished high school between 2019 and 2024 are functionally illiterate and cannot effectively comprehend what they read. Functionally illiterate meaning they do not meet updated standards that include comprehension and numeracy in real-life situations. (Functional Literacy, Education, and Mass Media Survey,2024).

The mastery of fundamental operations in mathematics is essential for developing critical skills, higher order problem solving skills and analytical skills among learners. However, many students continue to experience difficulties in mastering these basic mathematical concepts, which often hinder their overall academic performance. To address this challenge, innovative teaching approaches and learning interventions such as Strategic Instructional Materials (SIMs) have been introduced to enhance students’ engagement and understanding. It is recommended that teachers and school administrators integrate SIMs into remedial and enrichment programs to strengthen students’ foundational mathematical skills and promote a more engaging, student-centered learning environment (Segarino et al., 2022).

During class, the researcher observed that when students are given a simple word problem application that requires mathematical operations majority of the students demonstrated persistent challenges with applying basic mathematics skills. These include simple arithmetic operations, addition, subtraction, multiplication and division involving two-to-three digits number. As well as they struggle with simple operation of fractions. As a result, the students are just passive listeners, isolate themselves in the class discussion and obtain poor academic performance. This may be the result of the impact of extended period of pandemic and frequent suspension of classes caused by inclement weather.

The researchers believed that teaching mathematics requires dynamic teaching strategies that cater to the diversity of students. Teachers must integrate educational tools into personalized teaching practices. These tools will significantly help struggling students to

improve their numeracy skills. One of these educational tools were online math games, that are used as a supplementary approach to enhance learning in mathematics. This interests the researcher to investigate the Effect of Roblox Online Math Games as a support strategy to enhance Numeracy Skills of Grade 9 struggling students.

Innovative teaching strategies are essential for enhancing student engagement and comprehension in mathematics and economics education. Integrating technology, artificial intelligence (AI), and effective mentoring can transform traditional teaching methods and promote active learning. Educational technologies, including virtual classrooms, interactive software, and other online platforms, provide flexible and dynamic learning environments that allow students to learn at their own pace while receiving immediate feedback.

Interactive simulations and educational games can make complex concepts more engaging and accessible, fostering a deeper understanding. The AI-driven tools further enhance this approach by offering adaptive learning systems that analyze student performance, identify strengths and weaknesses, and deliver tailored content and exercises. Additionally, AI can automate administrative tasks, enabling educators to focus more on teaching and mentoring, while chatbots and virtual tutors offer instant support for continuous learning outside the classroom. Complementing these technologies, effective mentoring provides personalized guidance, helps students navigate challenging topics, develops critical thinking skills, and builds confidence.

Peer mentoring programs can further strengthen learning through fostering collaboration and support among learners. Incorporating the technology, AI, and mentoring in teaching mathematics creates a more personalized, interactive, and effective learning experience, enhancing both understanding and student outcomes (Ajuwon et al., 2024).

Roblox is a colorful online game where it offers best games that are highly created and this includes math games that enhance numeracy skills among its users, Robert Booth (2024). Roblox is an online game platform and game creation system developed by Roblox Corporation that allows users to program and play games created by themselves or other users (<http://en.m.wikipedia.org/wiki/Roblox>). Retrieved Sept. 15, 2025).

Roblox math game is a developmental tool to build a level-based learning system. Students can improve their thinking in mathematics and life reasoning, this helps students understand learning modules and apply what they have learned from the class (Weng, Tingsheng 2023).

Applying various online platform applications in teaching instruction is a modern teaching method. These are highly effective in engaging students and accommodating various learning styles. Emerging technologies, particularly digital math games, demonstrate considerable promise in improving students' engagement, understanding, and achievement in mathematics education (Luo et al., 2022). Providing computer game-based support for low performing in early numeracy skills improved their numeracy performance from pre-test to post-test (Aunio and Mononen, 2017).

On the other hand, conventional teaching methods or the teacher-centered instruction relied heavily on the behaviorist theory which was based on the idea that behavior changes are caused by external stimuli. Students in a teacher-centered classroom are passive where in teacher has the ultimate authority and in charge of learning process. Students do not have adequate opportunities to develop their critical thinking and problem-solving skills (Hamdi Serin, 2018).

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The conventional teaching methods are predominantly teacher centered, relying heavily on lectures and instructor-led discussions. In this approach, the teacher assumes full control over the learning process, selecting teaching materials, determining the syllabus, and designing assessments, which are then delivered to students through a series of lectures. As a result, students often occupy a passive role in the classroom, receiving information rather than actively engaging with it. This method tends to prioritize memorization and repetition over critical thinking, problem-solving and creativity (Williams, as cited in Magallanes 2019).

Furthermore, teacher-centered instruction, often referred to as traditional education, is an approach in which the instructor serves as the primary authority and the main source of information for students. In this method, the teacher directs the learning process, controls the content, and determines the pace of instruction, while students typically take a passive role, receiving knowledge rather than actively engaging with it (Ghafar, 2013).

Numeracy skills referred to the ability to understand and apply mathematical concepts in everyday life. It encompasses a broad range of skills, including number recognition, counting, sorting, measuring, problem-solving, estimating, identifying patterns, and performing basic operations such as addition and subtraction. These skills are essential not only for academic success but also for navigating daily life effectively (Raising Children Network, 2023).

The numeracy skills begin with a solid grasp of basic mathematical operations, which are crucial in mathematical understanding. These skills include a comprehensive set of abilities that allow individuals to use mathematical information in various real-world contexts. Numeracy is the ability to utilize, interpret, and communicate mathematical concepts to evaluate situations and solve practical problems (Indeed Editorial updated June 9, 2025).

In addition, without adequate numeracy skills, students may struggle to manage solving a basic mathematics problem. This means that students will be harder to predict cause and effect in a problem-solving situation. This will lead to feelings of inadequacy and lower self-esteem, affecting overall wellbeing. Consequently, it is imperative for teachers to implement numeracy-focused, task-oriented learning experiences, such as constructivist teaching approaches, to effectively enhance students' numeracy skills and promote deeper mathematical understanding (Sa'dijah et al., 2023).

Addressing the problem of strengthening the numeracy skills of the students may be significantly beneficial in improving their numeracy skills. And this is the very reason why this study was conducted to evaluate the Effect of Roblox Math Games as a strategy in enhancement intervention on the numeracy skills of Grade 9struggling students of Nicomedes R. Tubar Sr. National High School.

This study was anchored on the Experiential Learning Theory of Kolb (1984) which states that experiential learning focuses on the idea that the best way to learn things is by having experiences. According to this theory, learning is the process by which knowledge is created by transforming experience. To this end, giving student's high-quality enhancement learning materials that can gauge students' acquisition of the necessary skills and knowledge will directly involve them in the learning process. Learning is best conceived as a process, not in terms of outcomes. To improve learning in education, the primary focus should be on engaging students in a process that best enhances their learning process that includes feedback on the effectiveness of their learning efforts.

This study was also anchored on the Constructivist learning theory, based on Active Learning strategies by John Dewy (1859-1952). This theory helps teachers to build optimized learning environments and frameworks for effective instruction. This constructivist learning activity will serve as a teaching strategy that will lead students to engage actively in a hands-on

approach learning process. It is where students appear interacting actively in the learning process, and which will lead students to create and construct new ideas or concepts. Indeed, learning experience becomes more meaningful when students are given opportunities to engage, question and criticize. Overcoming students the freedom to explore, solve problems and overcome challenges creates a better learning outcome (Harry Cloke, 2023).

Moreover, this study was also anchored on Vygotsky's Social Constructivism Theory. Vygotsky viewed cooperative learning approach as important part of a process which leads to the social construction of knowledge. The major theme of the social constructivism framework is that social exchanges or interactions play an essential role in cognitive development. Instruction must be designed so that students effectively interact within the classroom and construct their own understanding.

Statement of the problem

The main purpose of this study was to investigate the effect of Roblox math games as teaching strategy to enhance the numeracy skills of Grade 9struggling students of Nicomedes R. Tubar Sr. National High School, Pase, San Dionisio, Iloilo for school year 2025-2026.

Specifically, this study sought to answer the following questions:

1. What is the level of numeracy skills of Grade 9struggling students in the pre-tests and post-tests of the control and the experimental groups?
2. Is there a significant difference in the numeracy skills of Grade 9 struggling students in the pre-tests of the control and the experimental groups?
3. Is there a significant difference in the numeracy skills of Grade 9 struggling students in the pre-tests and post-tests of the control and the experimental groups?
4. Is there a significant difference in the numeracy skills of Grade 9 struggling students in the post-tests of the control and the experimental groups?
5. What is the effect size of Roblox math games strategy on the numeracy skills of Grade 9 struggling students?

METHODOLOGY

This study was conducted to determine the effect of Roblox math games and conventional teaching strategies on the numeracy skills of Grade 9 struggling students of Nicomedes R. Tubar Sr. National High School, school year 2025-2026. The study employed a true experimental design in which both a control group and an experimental group were utilized. The dependent variable was first measured in each group prior to the introduction of the independent variable. The intervention or treatment, serving as the independent variable, was then administered only to the experimental group, while the control group did not receive the intervention. After the experimental group's exposure to the treatment, the dependent variable was measured again in both groups.

Specifically, the study utilized the pretest-posttest control group design, considered an extension of the posttest-only design with nonequivalent groups and regarded as one of the simplest and most effective methods for evaluating a treatment's impact. In this design, both groups were assessed before and after the intervention; however, only the experimental group received the treatment, while the control group underwent the same assessments without exposure to the intervention. Statistical analysis was then applied to determine whether the intervention produced a significant effect (Denny et al., 2023). In this design, the experimental group was assessed through a pretest, denoted as O1, followed by the administration of the

treatment, denoted as X, and then a posttest, denoted as O3. The control group, in comparison, was assessed through a pretest, denoted as O2, and a posttest, denoted as O4, without receiving the treatment in between. The experimental group was thus exposed to the intervention, whereas the control group was not, with the latter serving as a baseline for comparison. Prior to the implementation of the intervention, both the experimental group, represented by O1, and the control group, represented by O2, underwent survey observations and pretesting to establish baseline data. Following the implementation of the intervention in the experimental group, post-intervention observations and testing, represented by O3 and O4, were conducted for both the experimental and control groups to assess the effects of the treatment. The pretest aimed to establish the collective similarity of the two groups prior to the experiment, ensuring comparable baseline performance. Subsequently, the posttest scores, represented by O3 and O4, were analyzed and compared to determine the impact of the intervention (Falcis, 2016).

The Roblox math games strategy was used for the experimental group, while conventional strategies of teaching were used for the control group. The independent variables were the Roblox math games and conventional strategies, and the dependent variable was the numeracy skills of the Grade 9 students. The study utilized descriptive statistics such as the mean, standard deviation, and Cohen's *d* to summarize the data, while inferential analysis was conducted using a *t*-test at the 0.05 level of significance.

The participants of this study were the seventy-nine (79) identified struggling Grade 9 students of Nicomedes R. Tubar Sr. National High School for the School Year 2025-2026. These seventy-nine (79) Grade 9 struggling students were determined based on their average grades in Mathematics during the first quarter for School Year 2025-2026, with students who obtained below an 80% average grade in Mathematics during their first quarter grade considered struggling learners. The researcher created two groups out of the seventy-nine (79) Grade 9 struggling students. To assign the groups as either the control or experimental group, the researcher wrote the names of the struggling Grade 9 students separately on pieces of paper, rolled them, and placed them in a container. The first name picked was assigned to the first group, the second name was assigned to the second group, and the third name was again assigned to the first group, with the process continuing through alternate grouping until all students were divided into two groups. The researcher then wrote Group 1 and Group 2 on separate pieces of paper, rolled them, and drew them by lottery, assigning the first paper drawn as the experimental group and the second paper drawn as the control group. Students assigned to the experimental group were taught under the Roblox Math games strategy, while students assigned to the control group were taught using the conventional method of teaching. There were forty (40) struggling students in the experimental group and thirty-nine (39) struggling students in the control group.

A 53-item researcher-made numeracy skills test was used as the data gathering instrument to measure the numeracy skills of the Grade 9 struggling students. The numeracy skills test covered the fundamental operations including addition, subtraction, multiplication, and division of whole numbers and fractions. Prior to the conduct of the study, the numeracy skills test was subjected to face and content validation by three (3) Mathematics teachers from Nicomedes R. Tubar Sr. National High School and a panel of experts, and the feedback gathered from them was utilized to refine and enhance the numeracy skills test. After validation, an 80-item researcher-made test was pilot tested to thirty (30) Grade 9 struggling students of Tumble Integrated School, Tumble, San Dionisio, Iloilo, who were not participants of the study. The results of the numeracy test were subjected to item analysis through the Statistical Package for the Social Sciences (SPSS), with the analysis serving as the basis for determining which items were retained, revised, or discarded. According to Navaro (2012), items with a difficulty index of 0.26 to 0.75 and a discrimination index of 0.46 to 1.0 were retained. After the item analysis, 53 items out of the original 80 items remained and were used

as the final numeracy skills test. To interpret the numeracy skills of the Grade 9 struggling students, a scale was arbitrarily used wherein a score range of 42.41 to 53.00 was described as very high, a score range of 31.81 to 42.40 was described as high, a score range of 21.21 to 31.80 was described as average, a score range of 10.61 to 21.20 was described as low, and a score range of 0.00 to 10.60 was described as very low.

The researcher employed three phases in the conduct of the study, namely the pre-experimental phase, the experimental phase, and the post-experimental phase. During the pre-experimental phase, the researcher secured permission from the School Administration of Nicomedes R. Tubar Sr. National High School to conduct the study using the Grade 9 struggling students enrolled for the school year 2025-2026 as respondents. The researcher secured parental consent for the students' participation by providing a formal written letter outlining the purpose and procedures of the research, and conducted an orientation to inform the students about their participation in the study and to discuss its objectives, procedures, and other essential details. After receiving approval, the researcher identified the participating groups, with the number of participants for both groups determined by their average grades in Mathematics during the first quarter of School Year 2025-2026. The researcher prepared the numeracy skills test for both the pretest and posttest, along with other materials needed in delivering the lesson, prior to the actual conduct of the experiment. Prior to the start of the experiment, the teacher administered the pretest to both the experimental and control groups through face-to-face testing, and the results were subsequently checked, recorded, and organized for analysis using appropriate statistical methods. The test materials were kept secure, as they were later used as the posttest at the end of the investigation period.

During the experimentation phase, students in the experimental group were exposed to the Roblox Math games strategy, while the control group was exposed to conventional teaching. The experiment was implemented over four weeks, or one month, with lessons covering addition, subtraction, multiplication, division of whole numbers, and operations involving fractions for both the control and experimental groups. Prior to the implementation of Roblox in the classroom, the researcher conducted an orientation providing all student participants with information regarding the objectives of the implementation, and encouraged and supported learners, particularly those requiring intervention to enhance their numeracy skills.

For the experimental group, the researcher designed and prepared practice activities in the form of Learning Activity Sheets, supplemented with collaborative activities and game-based learning tasks for each week of intervention. In the first week, lessons focused on the addition and subtraction of multi-digit numbers. Students began with guided discussions and conceptual reviews to recall prior knowledge and ensure understanding of place value and regrouping, followed by collaborative exercises such as pair work and group problem-solving to promote peer learning and communication skills. To strengthen computational fluency, practice drills and speed challenges were conducted using both written and digital formats. Students then applied their learning through the course game Tower of Math on Roblox, which features quest-based challenges involving real-life mathematical problem situations, with the integration of this educational game aimed at motivating learners through gamified experiences and encouraging them to think critically, strategize, and apply computation skills in a contextualized and interactive environment. The week concluded with a reflection activity and short formative quizzes administered to assess understanding and provide feedback for improvement.

In the second week, instruction focused on the multiplication and division of multi-digit numbers. The researcher began by facilitating a review of prerequisite concepts to ensure that

students recalled foundational knowledge of number patterns and basic operations, followed by guided examples and interactive demonstrations allowing learners to visualize the process of multiplication and division through demonstrative and practical examples. Students then engaged in collaborative group skill-building tasks in which they solved challenging problems and presented outlines to peers. The researcher integrated the Math Obby course game on Roblox to enhance engagement and contextual application, presenting level-based multiplication and division challenges requiring patience, strategy, speed, and problem-solving. After gameplay, students took part in a reflective session discussing the outcomes of the activity, particularly the strategies they used to overcome obstacles and solve math problems, connecting game-based learning experiences to mathematical concepts and real-world problem solving.

In the third week, instruction focused on the addition and subtraction of fractions. To build conceptual understanding, students first engaged with fraction models and visual aids, allowing them to represent and compare fractions using concrete and pictorial methods. Guided problem-solving tasks were incorporated to emphasize finding common denominators and simplifying fraction results. The researcher employed the Math Fraction Roblox obstacle course game, which included real-life applications of fractional operations within interactive skill challenges, allowing learners to apply their computation skills in an engaging setting. Activity sheets and reflection notes were utilized to help students assess their numeracy skills by examining how they successfully completed each game level and how they developed new strategies that enhanced their knowledge in mathematics.

In the fourth week, lessons emphasized the multiplication and division of fractions. To reinforce mastery of operations involving fractions, the researcher employed Roblox Math Fraction Games, in which students encountered challenging levels requiring them to use their numeracy skills to successfully complete each stage, providing opportunities for them to discover new strategies that made the gameplay experience easier and more enjoyable. Students also participated in group collaborative gameplay tasks, analyzing and solving problems that required strategic computation and careful decision making. The session concluded with a self-reflection task in which students reflected on their confidence in solving fraction problems and discussed the strategies they found most effective. Throughout the four-week experimental period, the researcher continuously monitored and recorded students' progress using a daily record chart to assess improvement in numeracy fluency, including individual and group performance such as attendance, participation in instructional tasks, and overall performance. Weekly reflection sessions were also conducted to complement quantitative data, allowing students to share insights, discuss strategies, and evaluate their learning experiences, with the aim of strengthening conceptual understanding, promoting metacognitive awareness, and fostering a collaborative learning environment in which students actively constructed mathematical knowledge through dialogue and shared exploration.

For the control group, the researcher conducted the lessons using the conventional classroom approach, primarily involving lectures, board demonstrations, and clear presentation of learning instruction. The same lesson coverage and learning competencies were followed as those of the experimental group to ensure consistency of content, while the instructional strategies remained teacher centered. During the first week, the teacher discussed the addition and subtraction of multi-digit numbers through direct instruction and sample problem-solving on the board, with students given written exercises, daily drills, small group activities, and homework for practice to enhance speed and accuracy. In the second week, lessons focused on the multiplication and division of multi-digit numbers, with the teacher explaining the standard process and providing specific and clear examples, followed by individual seatwork, recitations, and short quizzes. The third week covered the addition and subtraction of fractions, with the researcher reviewing the concept of finding common denominators and guiding the

class through solving practice problems, while students completed learning activity sheet exercises, engaged in class discussions, and took a daily short quiz. During the fourth week, the focus was on the multiplication and division of fractions, with the researcher presenting thorough, structured steps for solving fraction operations and providing students the opportunity to practice on their own through individual drills and group tasks. Each session concluded with a brief short quiz and a brief self-reflection on what students had learned. Throughout the four-week duration, the researcher ensured that the control group's instruction remained consistent, emphasizing lectures, guided practice, and independent work. After four weeks, a posttest was administered to both the control and experimental groups, using the same numeracy skills test as the pretest but with the items shuffled.

During the post-experiment phase, upon completion of the four-week intervention, experimental group students who were engaged with the Roblox math games strategy were asked to share their personal feedback on the strategy's effectiveness, and the researcher recorded their responses for evaluation and as reference for future instructional improvements. The pretest and posttest scores of students from the control and experimental groups were systematically recorded, organized, and analyzed using suitable statistical techniques.

The data gathered were subjected to computer processed statistics using the Statistical Package for Social Sciences (SPSS) software. The mean was used to describe the level of numeracy skill of the Grade 9 struggling students both in the control and experimental groups. Standard deviation was used to determine the homogeneity and heterogeneity of the scores obtained by the students in the pretest and posttest. The t-test for dependent samples was used to determine whether significant differences occurred between the pretest and posttest results of both the experimental and control groups. The t-test for independent samples was used to assess whether there was a significant difference between the pretest and posttest scores of the experimental and control groups. Cohen's d was used to determine the effect size, indicating the standardized difference between two means.

RESULTS AND DISCUSSION

This chapter presents the results and discussion of the study, which was conducted to determine the effect of the Roblox math games strategy and the conventional teaching strategy on the numeracy skills of struggling Grade 9 students of Nicomedes R. Tubar Sr. National High School for the school year 2025-2026. The discussion is grounded in the data gathered from seventy-nine (79) participants, consisting of thirty-nine (39) students in the control group and forty (40) students in the experimental group, who were identified as struggling learners based on having obtained an average grade below 80% in Mathematics during the first quarter of the school year. Employing a true experimental, pretest-posttest control group design, the study utilized a 53-item researcher-made numeracy skills test as the primary data gathering instrument to measure students' numeracy skills before and after the four-week intervention period. Descriptive statistics, including the mean and standard deviation, were used to describe the level of numeracy skills of the respondents, while inferential statistical tools, specifically the independent samples t-test, the paired samples t-test, and Cohen's d, were employed to determine the significance of differences and the magnitude of the intervention's effect at the 0.05 level of significance. The results presented in this chapter are interpreted in direct relation to the objectives of the study, and each finding is discussed in light of relevant statistical evidence and existing scholarly literature.

Level of numeracy skills of struggling Grade 9 students in the pretests and posttests of the control and experimental groups

Data revealed that the level of numeracy skills of struggling Grade 9 students in the pretests of both the control and the experimental groups was very low, with the control group obtaining a mean of 8.38 and a standard deviation of 4.79, and the experimental group obtaining a mean of 8.88 and a standard deviation of 6.34. These values fall within the 0.00-10.60 scale range, which is verbally interpreted as very low. After four weeks of intervention, the posttest data showed that the numeracy skills of students exposed to the Roblox math games strategy reached a very high level, with a mean of 43.38 and a standard deviation of 6.55, falling within the 42.41-53.00 range, while those taught using the conventional method of teaching attained a high level, with a mean of 35.13 and a standard deviation of 6.35, falling within the 31.81-42.40 range.

The very low level of numeracy skills obtained by both groups at pretest reveals that students in the experimental and control groups possessed nearly identical numeracy competencies at the start of the intervention, particularly in addition, subtraction, multiplication, division, and operations involving fractions. This near-identical baseline may be attributed to similar opportunities for learning and skill development, as well as uniformity in instructional practices and classroom experiences, given that both groups were likely exposed to the same curriculum content, teaching strategies, and learning environment prior to the study. The very low pretest results further suggest that these struggling students, whose average grades fell below 80%, may have accumulated learning gaps in basic arithmetic operations from earlier grade levels, possibly due to insufficient exposure to meaningful, contextualized instruction and real-life mathematical applications. When such foundational competencies remain unmastered in the lower grades, students tend to experience increasing difficulty as mathematical concepts grow more complex, leaving them inadequately prepared to engage with the Grade 9 curriculum, as reflected in their very low pretest scores.

Following the intervention, both groups demonstrated an increase in numeracy skills from pretest to posttest, indicating that measurable improvement occurred regardless of the instructional strategy employed. However, the experimental group achieved a very high result compared to the control group's high result, yielding a mean difference of 8.25 in favor of the experimental group, which suggests that the use of Roblox math games in teaching is more effective than the conventional strategy. This considerable improvement in the experimental group may be attributed to the interactive and engaging nature of Roblox math games, which promote active participation, repeated practice, and immediate feedback. Such features strengthen comprehension and retention of basic operations and fraction concepts while increasing motivation and focus, thereby reducing anxiety and encouraging persistence in solving mathematical tasks. This finding implies that technology-supported teaching innovations and learner-centered strategies can meaningfully improve mathematical skills, particularly among students who begin with very low numeracy levels, highlighting the potential of game-based learning as an effective alternative or complement to conventional teaching methods. Moreover, the fact that both groups showed improvement regardless of instructional strategy indicates that learning occurs when effective teaching and collaborative interactions are present, even though the game-based approach yielded superior outcomes.

This result is in consonance with the study of Quiohilag (2023), which revealed that students' numeracy skills in the pretests of both the experimental and control groups were very low, and that after the intervention, the experimental group attained a very high level of numeracy skills while the control group attained a high level. This finding is also parallel to the study of Bolivar (2024), in which non-numerate students' proficiency in the four fundamental operations was very low in the pretests of both groups, but after the intervention, the control

group reached a low level of proficiency while the experimental group reached a very high level.

Difference in numeracy skills of struggling Grade 9 students between the pretests of the control and experimental groups

An independent samples t-test was conducted to determine whether a significant difference existed in the numeracy skills of struggling Grade 9 students between the pretests of the control and experimental groups. The results showed that there was no significant difference in numeracy skills between the two groups at pretest, $t(77) = 0.387$, $p = 0.700$, which is greater than the 0.05 level of significance. This finding implies that both groups were statistically comparable in terms of numeracy skills prior to the implementation of the intervention. This comparability is supported by the fact that the participants were selected based on similar average grades during the first quarter in Mathematics, confirming that the groups used in the study were homogenous and thus suitable for comparing the effects of the Roblox math games strategy and the conventional teaching strategy, establishing a collective similarity between groups at the beginning of the experiment.

This finding affirms the study of Igcasenza (2025), which found no significant difference in the mathematics proficiency of Grade 10 students with difficulties in Mathematics between the pretests of the experimental and control groups. It is also parallel to the study of Bolivar (2024), which found no significant difference in the proficiency in the four fundamental operations of Grade 7 non-numerate students between the pretests of the control and experimental groups, as well as to the study of Panizales (2025), which found no significant difference in the numeracy skills of junior high school non-numerates between the pretests of the control and experimental groups. Given these results, the null hypothesis stating that there is no significant difference in numeracy skills of struggling Grade 9 students between the pretests of the control and experimental groups is hereby accepted.

Differences in numeracy skills of struggling Grade 9 students between the pretests and posttests of the control and experimental groups

A paired samples t-test was conducted to determine whether significant differences existed between the pretest and posttest numeracy scores within each group. The results showed a significant difference in numeracy skills between the pretest and posttest of the control group using conventional teaching strategies, $t(38) = 45.260$, $p = 0.000$, as well as a significant difference in numeracy skills between the pretest and posttest of the experimental group using the Roblox math games strategy, $t(39) = 41.853$, $p = 0.000$, both of which fall below the 0.05 level of significance.

The significant difference within the control group implies that conventional teaching remained effective in enhancing students' numeracy skills, particularly in basic operations and fractions. This finding suggests that consistent instruction, practice, and guided activities provided by the teacher, even without interactive or game-based intervention, can help struggling learners develop essential mathematical skills. Although the control group received only conventional instruction focused on basic arithmetic operations and fractions, this approach still produced a positive impact, resulting in markedly improved posttest scores. This further demonstrates that struggling learners can benefit from clear explanations, step-by-step problem-solving, and repetitive practice, which strengthen understanding and build confidence in performing mathematical operations even without technology-based instruction. Nonetheless, while this improvement was substantial, it remained lower than that achieved by the experimental group, indicating that conventional methods may be less effective in

maximizing learning outcomes compared to more engaging, interactive, technology-based approaches.

This finding is parallel to the study of Bolivar (2024), which found a significant difference in the proficiency in the four fundamental operations of Grade 7 non-numerate students between the pretests and posttests of the control group. It also affirms the results of Igcasenza (2025), which found a significant difference in the mathematics proficiency of students with difficulties in Mathematics between the pretests and posttests of the control group, as well as the study of Falcis (2017), which found a significant difference in the mathematics performance of Senior High School students between the pretest and posttest of the control group. Therefore, the null hypothesis stating that there is no significant difference in numeracy skills of struggling Grade 9 students between the pretests and posttests of the control group is hereby rejected.

Similarly, the results within the experimental group also showed a significant difference between pretest and posttest scores. The increase in mean scores from a very low level at pretest to a very high level at posttest implies that the use of Roblox math games as an educational tool effectively enhanced students' understanding of basic arithmetic operations and fractions. This denotes that interactive and game-based learning environments can promote active engagement, sustained motivation, and repeated practice, which are essential factors in developing numeracy skills among struggling learners. The considerable improvement further indicates that when students are provided with meaningful, engaging, and learner-centered activities, they are more likely to achieve deeper conceptual understanding and improved computational accuracy. This suggests that integrating innovative digital tools such as game-based learning platforms may serve as an effective instructional approach to address low numeracy levels and support students' mathematical development, as interactive and technology-supported learning environments can enhance engagement, encourage active participation, and provide opportunities for repeated practice essential to strengthening numeracy skills among struggling learners.

This result is in consonance with the study of Igcasenza (2025), which found a significant difference in the mathematics proficiency of Grade 10 students with difficulties in Mathematics in the posttests of the experimental group. It also affirms the study of Albason (2018), which found a significant difference between the posttest performances of the experimental and control groups, with the experimental group demonstrating superior mathematics performance, and is parallel to the study of Falcis (2017), which found a significant difference in the mathematics performance of Senior High School students between the pretests and posttests of the experimental group. Furthermore, this finding affirms the study of Faridah and Deng (2024), which found that Roblox math games can significantly increase student involvement in discussions and raise interest in learning activities through their interactive features. Therefore, the null hypothesis stating that there is no significant difference in numeracy skills of struggling Grade 9 students between the pretests and posttests of the experimental group is hereby rejected.

Differences in numeracy skills of struggling Grade 9 students between the posttests of the control and experimental groups

An independent samples t-test was conducted to compare the posttest numeracy scores of the control and experimental groups. The results showed a significant difference in numeracy skills between the posttests of the two groups, $t(77) = 5.681$, $p = 0.000$, in favor of the experimental group, which is below the 0.05 level of significance.

This significant difference implies that the intervention applied to the experimental group, the technology-based Roblox math games strategy, positively influenced the numeracy

skills of struggling students, resulting in a remarkably higher posttest outcome compared to the control group. This significant difference may be attributed to the digitally interactive and learner-centered nature of the Roblox math games strategy, which promotes active participation, sustained engagement, and immediate feedback among students. Such features allow students to practice skills repeatedly while receiving continuous reinforcement, thereby strengthening retention and mastery of mathematical concepts. Additionally, game-based environments can increase students' motivation and reduce anxiety toward learning mathematics by presenting learning tasks in an engaging and less intimidating format. These factors contribute meaningfully to improved learning outcomes, particularly among struggling learners who may benefit from alternative instructional approaches beyond conventional methods, and the results suggest that the integration of Roblox math games provided enhanced learning opportunities that supported deeper conceptual understanding and improved computational skills in basic arithmetic operations and fractions. The findings further underscore the importance of adapting instructional practices to include interactive and experiential learning opportunities that address diverse learning needs and promote meaningful engagement in mathematics.

This finding affirms the study of Diaz (2022), which found that posttest results indicated a significant difference in mathematics performance between the control and experimental groups. It also affirms the findings of Quiohilag (2023), which found a significant difference in the numeracy skills of Grade 7 non-numerates between the posttests of the control and experimental groups, and is parallel to the study of Albason (2018), which found a significant difference between the posttest performances of the experimental and control groups, with the experimental group demonstrating superior mathematics performance. However, this study contradicts the results of Consolacion (2018), which found no significant difference between the posttests of the control and experimental groups. Therefore, the null hypothesis stating that there is no significant difference in numeracy skills of struggling Grade 9 students between the posttests of the experimental and control groups is hereby rejected.

Effect size of the Roblox math games strategy on the numeracy skills of struggling Grade 9 students

The results revealed that the effect size of the Roblox math games strategy on the numeracy skills of struggling Grade 9 students, computed using Cohen's d , was 1.29, which is interpreted as a large effect based on the standard benchmarks in which a value of 0.2 indicates a small effect, 0.5 indicates a medium effect, and 0.8 indicates a large effect.

This large effect size implies that the Roblox math games strategy is an effective approach for enhancing students' numeracy skills. The posttest results further demonstrate that students in the experimental group, who were exposed to the Roblox math games strategy, achieved a very high level of numeracy skills, whereas those in the control group, taught using conventional methods, attained only a high level of numeracy proficiency. This indicates that the intervention using the Roblox math games strategy was highly effective in enhancing students' mastery of basic arithmetic operations and fraction concepts compared to conventional teaching methods. The substantial effect size implies that game-based learning not only improved performance but also produced meaningful and practically significant learning gains, highlighting the potential of interactive, digitally supported, and learner-centered instructional strategies in transforming mathematics education, particularly for learners who struggle with numeracy. Furthermore, integrating Roblox math games approaches into teaching mathematics can provide students with engaging, motivating, and highly effective

learning experiences that lead to measurable improvements in skill development, as the learner-centered environment and interactive nature of Roblox game-based activities promote active engagement, problem-solving, and experiential learning that contribute meaningfully to improved numeracy skills among Grade 9 struggling learners.

This result affirms the study of Quiohilag (2023), which found that cross-age peer tutoring had a large effect size on the numeracy skills of non-numerate Grade 7 students, and is parallel to the study of Nagtalon (2016), which found that the Singaporean Model had a very large effect on enhancing the mathematics performance of Grade 6 pupils. It also agrees with the study of Diaz (2022), which found that the effect size of strategic intervention materials on the mathematics performance of Grade 9 low-achieving learners was large, highlighting the intervention's strong impact on enhancing students' mathematical abilities. However, this study is not aligned with the study of Reliente (2019), which found that the effect size of the agile learning approach on the mathematics performance of Grade 10 students was very large, nor does it agree with the result of Lagos (2022), which found that the effect size of the Barangay-Based Remediation Program on the numeracy skills of Grade 4 pupils was very large.

Taken together, the findings of this study establish that the seventy-nine (79) struggling Grade 9 students in both the control and experimental groups began the intervention period with statistically comparable, very low levels of numeracy skills, as confirmed by the absence of a significant difference in their pretest scores, $t(77) = 0.387$, $p = 0.700$. This initial homogeneity provided a valid basis for evaluating the differential effects of the two instructional strategies. Following the four-week intervention, both groups exhibited statistically significant gains in numeracy skills, as shown by the paired t-test results for the control group, $t(38) = 45.260$, $p = 0.000$, and for the experimental group, $t(39) = 41.853$, $p = 0.000$, confirming that both conventional teaching and the Roblox math games strategy were effective in improving students' numeracy skills. However, the significant difference found between the posttest scores of the two groups, $t(77) = 5.681$, $p = 0.000$, together with the large effect size of $d = 1.29$, demonstrates that the Roblox math games strategy produced markedly superior and practically meaningful gains in numeracy skills compared to the conventional teaching strategy. These results directly address the objectives of the study by empirically establishing that game-based, technology-supported instruction can serve as a highly effective intervention for struggling learners, offering a valuable contribution to the growing body of literature on innovative pedagogical strategies in mathematics education. These findings, having been established through rigorous quantitative analysis grounded in the data gathered from the respondents, provide the empirical foundation for the summary, conclusions, and recommendations presented in the succeeding chapter.

CONCLUSION

Based on the findings of the study, several conclusions were drawn regarding the numeracy skills of Grade 9 struggling learners and the relative effectiveness of the Roblox math games strategy compared to conventional teaching. At the outset of the intervention, both the control and experimental groups exhibited very low numeracy skills in the pretest, reflecting similar baseline competencies and existing learning gaps in basic mathematical operations such as addition, subtraction, multiplication, division, and operations involving fractions. This very low performance suggested that students initially lacked essential numerical understanding, computation skills, number sense, and problem-solving ability, pointing to gaps in prior learning or limited mastery of prerequisite skills. Because both groups demonstrated comparably low performance at the start, it can be concluded that the groups were relatively equivalent prior to the intervention, a condition that strengthens the validity of the study since

subsequent improvements in the posttest can be more confidently attributed to the intervention itself rather than to pre-existing differences between groups.

This initial comparability was further confirmed statistically, as no significant difference was found in the numeracy skills of Grade 9 struggling learners between the pretests of the control and experimental groups. This outcome may be attributed to the homogeneity of the students within each group and the similarity of their numeracy skills prior to the introduction of the intervention, a similarity supported by the fact that participants were selected based on comparable average grades in Mathematics during the first quarter. The comparability of the two groups indicates that they were suitable for inclusion in the study and that no bias existed in the selection of respondents, as collective similarity was evident at the beginning of the experiment. This equivalence provided a valid basis for assessing the subsequent effects of the intervention on both groups.

Following the implementation of the intervention, both groups demonstrated marked improvement in their numeracy skills, with the experimental group achieving a very high level of performance and the control group achieving a high level. This increase from pretest to posttest in both groups indicates that genuine improvement in numeracy skills occurred as a result of instruction, whether through exposure to the Roblox math games strategy or through the conventional method of teaching. Notably, the experimental group's improvement proved more substantial than that of the control group, suggesting that the Roblox math games strategy was more effective than the conventional approach in enhancing numeracy outcomes. This considerable improvement may be attributed to the interactive and engaging nature of Roblox math games, which promote active participation, repeated practice, and immediate feedback, and the finding suggests that incorporating digital game-based platforms such as Roblox as an instructional intervention can serve as an effective supplementary strategy for improving numeracy outcomes and fostering positive learning experiences among students.

The significant difference observed between the pretest and posttest scores of the experimental group further affirms that the Roblox math games strategy had a meaningful impact on students' numeracy skills, indicating that integrating digital game-based learning approaches can enhance engagement and support the development of essential mathematical skills among learners experiencing difficulties. The interactive nature of the game-based environment appears to have enhanced motivation, participation, and conceptual understanding among Grade 9 struggling learners by allowing repeated practice, continuous engagement, and active learning, all of which facilitate skills reinforcement and support the progressive development of numeracy skills and retention of mathematical concepts. This significant improvement in the experimental group's results demonstrates the learning gains achieved through the strategy implemented by the teacher, confirming that the strategy was effective in improving the numeracy skills of struggling learners.

At the same time, the significant difference found between the pretest and posttest scores of the control group implies that conventional teaching remained effective in enhancing students' numeracy skills, particularly in basic operations and fractions, demonstrating that even without a technology-based intervention, traditional instructional approaches can still produce meaningful improvements in learners' performance in core numeracy areas. This finding suggests that consistent instruction, practice, and guided activities provided by the teacher can help struggling learners develop essential mathematical skills, and that clear explanations, step-by-step problem-solving, and repeated practice can enhance comprehension and build learners' confidence in performing mathematical operations, even in the absence of game-based instruction.

When the posttest results of the two groups were compared directly, a significant difference was found in favor of the experimental group, implying that the Roblox math games strategy, as a technology-based intervention, positively influenced the numeracy skills of struggling learners and produced a markedly higher level of achievement than conventional instruction. This finding demonstrates that Roblox math games serve as an effective and reliable tool for improving numeracy skills among struggling students, as the gamified approach's capacity to foster active engagement, immediate feedback, and repeated practice enabled learners to achieve higher mathematical proficiency compared to those exposed only to conventional instruction. This significant result may be attributed to the digitally interactive and learner-centered nature of the Roblox math games strategy, which promotes active participation, sustained engagement, and continuous reinforcement of mathematical concepts while simultaneously increasing students' motivation and reducing anxiety toward mathematics by presenting learning tasks in an engaging and less intimidating format. These results highlight the considerable potential of integrating interactive digital games into mathematics education as an effective and evidence-based method for improving numeracy proficiency among struggling learners.

Finally, the Roblox math games strategy was found to have a large effect on the numeracy skills of Grade 9 struggling learners, indicating that it was highly effective in enhancing students' mastery of basic arithmetic operations and fraction concepts compared to conventional teaching methods. A large effect size signifies that the intervention produced substantial improvement in learners' ability to understand numbers, perform calculations, and apply mathematical concepts, consistent with findings in game-based learning research showing that digital games often lead to higher numeracy achievement than traditional instruction because learners actively practice mathematical skills within an interactive environment. This large effect further suggests that engagement and motivation played a major role in improving numeracy performance, allowing learners to develop deeper numerical understanding and helping struggling students move beyond rote procedures toward more meaningful mathematical reasoning. The continuous practice afforded by the Roblox platform appears to have supported faster mastery of numeracy skills, confirming that the integration of Roblox math games produced a large and meaningful improvement in the numeracy skills of Grade 9 struggling learners. Roblox math games can therefore be considered an effective and innovative instructional strategy for supporting numeracy development and improving mathematical performance among low-achieving students, as its gamification elements, including levels, rewards, and challenges, promote sustained engagement and motivation, while real-time feedback enables learners to immediately recognize errors, refine their problem-solving strategies, and successfully complete mathematical tasks. The sense of achievement gained through progression across levels and successful task completion contributes to increased engagement, confidence, and persistence in solving mathematical problems, while the collaborative features of Roblox math games allow students to interact, collaborate, or compete with others, promoting social learning and peer engagement. Beyond improving numeracy skills, the integration of Roblox math games also appears to cultivate digital responsibility among learners by promoting self-regulation, ethical engagement, respectful collaboration, adherence to rules, and mindful decision-making within digital environments.

Taken together, these findings affirm that while both conventional teaching and the Roblox math games strategy are capable of producing significant improvements in the numeracy skills of Grade 9 struggling learners, the Roblox math games strategy consistently yielded superior and more substantial gains, as evidenced by higher posttest performance and a large effect size. It is therefore recommended that mathematics teachers and school administrators consider integrating Roblox math games and similar digital game-based

platforms into instructional practice, particularly for struggling learners, as a supplementary strategy to conventional teaching in order to enhance engagement, motivation, and mastery of foundational numeracy skills. Continued use of guided, interactive, and structured instructional activities within conventional teaching should likewise be sustained, given their demonstrated effectiveness in producing meaningful learning gains even without technology-based tools. Furthermore, schools and educators are encouraged to explore the broader adoption of gamified and technology-supported learning strategies as part of a comprehensive approach to addressing numeracy gaps, while remaining mindful of fostering digital responsibility, self-regulation, and ethical engagement among learners as they interact with digital learning environments.

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