MULTIPLICATION MASTERY PROJECT: AN INTERVENTION TO ENHANCE THE MULTIPLICATION SKILLS OF GRADE-III PUPILS

Cabanes, Johna Fe B.; Deniega, Jeanette O.; Geverola, Aimae C.

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Cabanes, Johna Fe B.; Deniega, Jeanette O.; Geverola, Aimae C.
Santa Lucia Elementary School
Department of Education, Division of Pagadian City
email: johnafe.cabanes@deped.gov.ph; jeanette.deniega@deped.gov.ph;
aimae.calma@deped.gov.ph
09463048020/ 09094823291

Abstract

The study's objective was to assess the influence of the Multiplication Mastery Project on basic multiplication skills as a necessity for elementary pupils because it encourages the development of skills as mathematics concepts get more challenging. The study was conducted in Santa Lucia Central Elementary School, Pagadian City, during the first quarter of School Year 2022-2023, and consisted of 169 grade 3 pupils. Data collection methods included a pretest, a posttest of the Multiplication Mastery Test, a progress monitoring chart, a teacher observational journal, and a student conference notebook. After the eight-week implementation of the Multiplication Mastery Project, the data revealed significant differences in the participants' multiplication skills and accuracy in responding to complex multiplication problems. The results also emphasized that the posttest produces a mean of 25.49 and an SD of 4.61, which is undeniably higher than that of pretest results with a standard of 15.84. The results further connote that the Multiplication Mastery Project plays a significant role in increasing the performance of the Grade 3 pupils in multiplication skills. Based on these results, there was a growing requirement for students to strengthen their fundamental multiplication skills in the early years of their elementary level to understand increasingly complex arithmetic ideas further. Thus, the researchers will continue implementing Mastery Project Intervention and have further innovations to increase student achievement.

Keywords: *Multiplication Fluency; Multiplication Mastery Project; Multiplication Skills*

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Cabanes, Deniega, and Geverola.

Context and Rationale

Teaching mathematics brought extraordinary challenges because it is one of the subjects that pupils struggle to learn. It is also a subject that most pupils give little attention to, and they hated it during the pandemic since physical distance appears to obstruct realizing the ideals of learning. In 2018, 50% of Filipino pupils obtained lower scores than the minimal proficiency level in Programme for International Student Assessment (PISA) mathematics assessment. Sadly, public schools underperformed compared to private schools (Bernardo 2022). Southeast Asia Primary Learning Metrics 2019 (SEA-PLM) exposed that in terms of mathematical standards, only 17 percent of the learners met them at the conclusion of primary education, and the Philippines ranked 2nd to worst in Grade 5 learners' math proficiency in Southeast Asia (Dela Pena 2023). Consequently, there is a rising requirement for teaching aids and instructional materials and measuring the use of mathematical expertise and knowledge in practical settings.

Research shows that acquiring math skills early is a reliable indicator of future mathematical advancement (Duncan 2007; Watts 2014). It is also more with the usefulness of gained mathematical skills and knowledge (Kilpatrick 1996; De Lange 1999; Toner 2011), it is a better indicator of future success, which will help them to think critically, handle many daily tasks, and then to be able to get a job (Brown and Snell 2000; Cihak and Foust 2008; Watts 2014). Achieving the criteria for mathematical competency requires proficiency in mathematics at all grade levels (Mullis 2016; National Mathematics Advisory Panel 2008; Organization for Economic Co-Operation and Development (OECD) 2014). However, after two years of modular learning, many elementary pupils could not master basic addition, subtraction, multiplication, and division skills in the realm of mathematics. The researchers feared that if the learning gap is not filled, there will be a greater chance of failing in school concerning mathematics because as grade level increases, greater complexity of mathematical problems (Cai 2007).

Mostly, lower-grade level learners face the daunting challenge of memorizing multiplication tables. As part of a strong foundation for future arithmetic study, it is a crucial skill that unlocks the realm of multiplication, but many students lack it to the extent that have not able to master it, and most of them do not enjoy it. It heightened when the education system abruptly adopted a new learning modality. According to Lambdin (2009), the higher the grade level, the more critical mathematical skills are demanded. Such a strong foundation in mathematics significantly impacts the latter part of their studies and takes up their adult lives at home and in the workplace. The alleged challenges with multiplication fluency to the extent that they persist in this study, the researchers will investigate to evaluate pupils' ability to memorize multiplication tables as one of the foundations of mathematical skills as an edge to develop a capacity to tackle quantitative problems in real-world, everyday contexts.

In this concern, the researchers conducted this study to explore some interventions to increase fluency in multiplication by understanding, interpreting, and grasping the concept, considering that the first operation in the larger number domain that necessitates using strategies is this one (Burns 2015; Pólya 2002; Stein 2006). This study focused on the Grade - III elementary pupils of Santa Lucia Central Elementary School, Santa Lucia District, Pagadian City. They were subject to multiplication fluency intervention to give them more time to acquire fundamental knowledge and automate the basic memory of single-digit multiplication facts (Park and Nunes 2001; Stein 2006; Thornton 1989) so that they could be able to pupil solve faster by an automated recall to determine how to accomplish the task (Lerner 2003; Logan 1996; Stein 2006).

Supporting and teaching math at the elementary level dramatically affects the role of the teachers and parents. There is a greater chance that pupils will continue to struggle in multiplication skills during the elementary level because of a lack of a solid foundation, appropriate educational methods, and interventions. This study directs to determine an intervention to increase multiplication fluency in Grade - III elementary pupils in Santa Lucia Central Elementary School.

This study was anchored on the Cognitivist Theory of Jean Piaget, which stressed that pupils need to apply cognitive strategies of goals and sequences of mental operation to learn, solve word problems, and use them to learn more advanced math objectives (Bliss 2010; McCallum 2004). Also, this study assesses how pupils establish a conceptual link between their multiplication abilities and develop their sensory and reasoning competency. Action research was the methodology used to conduct the study.

Innovation, Intervention, and Strategy

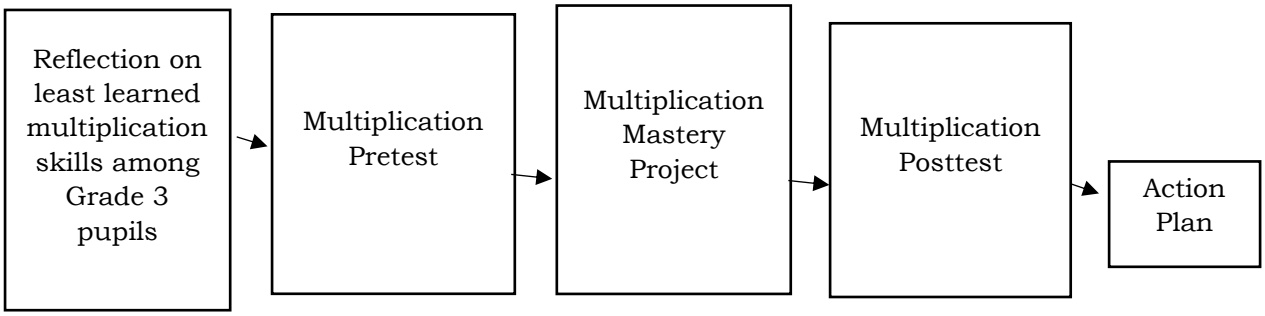
This school year, 2022-2023, the Department of Education (DepEd), observed a face-to-face mode of learning. Most teachers have attended a learning gap brought about by the distance learning modality during COVID-19 global pandemic (Torres 2021). As mathematics teachers, it is manifested in their output that many children find learning to multiply numbers challenging; it requires high patience and dedication. Thus, addressing it effectively with the different learning interventions is a must!

Fluency, quick recall, and complete comprehension of multiplication will increase a learner's confidence in the topic. This fundamental ability is necessary for a number of the duties that must be completed both at home and at school. Multiplication must be conceptually understood by children. So that learners can understand "why" and "how" the multiplication table works rather than just "what." This deeper level of reasoning enables practical application. These will make it possible for students to apply the skill in other areas of their learning successfully. The significance of knowing these mathematical fundamentals is still as important today as it was in the past, even though many of these ways of teaching multiplication have become obsolete. In this regard, it motivated the writers to develop an activity that counter-attacked the students' difficulty mastering multiplication tables.

This study explored some intervention and teaching strategies to increase multiplication fluency through the Multiplication Mastery Project, an Intervention to Enhance the Multiplication Skills of Pupils. The primary concern is to develop fastness and accuracy in academic responding, a stepping stone to creating across skill and subject areas (Haring and Eaton 1978; Poncy 2010).

A conceptual schema is illustrated below (Figure 1): The Multiplication Mastery Project Flow Chart. As shown in the figure, the study centers on the difference between the lecture method class and the application of the Multiplication Mastery Project.

Figure 1: The Flow Chart of the Multiplication Mastery Project



Multiplication Mastery Project is an innovation of instruction and learning that prioritizes firsthand, multisensory experiences; it occurs outside the four walls and employs an integrated manner of knowledge that incorporates the natural world, giving pupils options available to them outside of the classroom setting to see sustainability in action and practical applications. Moving outside the comfort zone can be a perfect opportunity to incorporate fun activities that give pupils more practice to serve as an aid in developing a solid foundation in multiplication skills so that Grade three pupils can navigate complex problems with ease and be able to apply transfer procedures and skills accurately and accessible to new concepts. This project was an intervention to increase multiplication fluency that could help the Grade- III pupils access multiplication concepts while having fun at the same time.

This Multiplication Mastery Project requires pupils' active engagement in the mental process of building multiplication skills and not merely a rote memorization routine. It requires teachers to remove themselves from indoors and experiment with outdoor learning. This intervention aimed at reinforcing skills from previous lessons and giving Grade-III pupils more opportunities to participate in practical lessons outside to develop multiplication and other mathematical skills.

Action Research Questions

This study focuses on developing and implementing the Multiplication Fact Fluency Program to improve basic multiplication fact recall of Grade-III pupils. This study was conducted to address the following questions explicitly:

1. What is the level of pupils' multiplication skills as revealed in the pretest?
2. What is the status of pupils' multiplication skills shown in the posttest after using the multiplication mastery project?
3. Is there a significant difference in the level of multiplication skills before and after implementing the innovation?
4. What enhanced innovation can be made?

Action Research Method

Research Design

This study uses a pre-experimental research design, as shown in Figure 1. Pre-experimental design When actual experiments and quasi-experiments are impossible, researchers may use a pre-experimental method (Campbell and Stanley 1963). Pre-experimental methods are called such because they often happen as a precursor to conducting an actual experiment. The investigation was conducted during the first quarter of the school year 2022-2023. Pupils identified as struggling with multiplication fluency were subjected to intervention during their remedial class session in the afternoon.

Participants and/or other Sources of Data and Information

This study was conducted on Grade - III learners who have difficulty memorizing the multiplication tables in one of the public elementary schools of Pagadian City Division. All of the Grade - III pupils in the school were subjected as participants. There were five sections. The diagnostic test consists of 30 items multiple choice.

Research Instruments

Research instruments utilized in this investigation include the respondent multiplication mastery level before and after the study, tracking every procedure's beginning and ending points, as well as its efficacy will be used in this study. The Diagnostic Test (Pretest and Posttest) includes questions that would portray the non-numerated pupils in the multiplication table. The number of multiplication facts measured basic fact recall in a one-minute multiplication test, all questions were answered correctly. The 60 horizontally displayed multiplication questions on the pretest were drawn at random from tables 0 to 10. Moreover, observation diaries, which detail the observation practices and critical thinking of non-numerates, were also used in this exploration.

Data Gathering Procedure

The current study was subject to specific ethical issues. The written consent address to the school principal and Grade - III class advisers was facilitated before the survey. Both letters aimed to reassure participants that their participation was voluntary and that refusing to participate would not affect their academic report. Pupils were informed that the completed pretest and posttest would be stored securely and treated with strict confidence. The research instruments did not include confidential data such as parents' income or whether the pupils' family receives government social benefits and grants.

A pretest was administered to identify the least learned multiplication skills of Grade III pupils. This served as the assessment of the intervention activities to be employed that are suitable to the needs of the learners. The posttest was administered within two days after implementing the Multiplication Mastery Project or Multiplication Fluency Practice sessions. All examinations were given during their usual mathematics time with their subject teacher. Participants were invited to engage in every activity. A maintenance test was conducted to monitor the current level of their multiplication skills. Each pupil was invited to complete questions in order, and if there were items they did not know, they might skip them. The teacher will give another multiplication fluency activity to answer their difficulties. Even multiplication fluency practice sessions were conducted over four weeks. A timer was used to time each 15-minute practice session.

Moreover, a Focus Group Discussion was also conducted with the teachers to discuss the best methods for teaching non-numerates.

Data Analysis

Descriptive statistics were utilized to analyze and interpret the data, such as the mean, which measures the average, and the standard deviation, which quantifies the variability of numerical measurements. The null hypothesis that there is no significant difference in the students' multiplication math achievement was tested using the Paired-Samples T-test. This statistical test procedure was utilized coupled with the usage of the level of marginal statistical significance, p–value, for the rejection or acceptance of the null hypothesis. The predictive analytics program Statistical Package for the Social Sciences (IBM SPSS Statistics 20) was utilized to conduct these statistical analyses.

To determine the level of pupils' mathematics achievement in multiplication as revealed in the pretest and posttest results, the Mean Percentage Scores (MPS) and their descriptive equivalent were used. The scoring system was adapted from DepEd Memo No. 160, s. 2012. Specified below is the mastery/achievement level:

MASTERY/ACHIEVEMENT LEVEL

MPS	Descriptive Equivalent
96 – 100%	Mastered
86 – 95%	Closely Approximating Mastery
66 – 85%	Moving Towards Mastery
35 – 65%	Average
15 – 34%	Low
5 -14%	Very Low
0 – 4%	Absolutely No Mastery

To determine the degree of enhancement of multiplication mastery project towards the multiplication skills of Grade-III pupils. The researchers used a Paired t-test. Statistical Package for the Social Sciences (SPSS) was utilized to examine the difference between two variables for the same subject, namely the pretest and posttest. The two variables are frequently separated in time.

Results and Discussions

Pupils' Multiplication Skills. Table 1 displays the mathematics achievement in the multiplication of the Grade 3 pupils of Sta. Lucia Central Elementary School in terms of Mean Percentage Score (MPS) in the pretest and posttest. Accordingly, the pupils achieved average mathematics in the pretest and moved towards mastery level in the posttest, as revealed in the Mean Percentage Score (MPS).

Table 1: Level of Pupils' Academic Achievement in Multiplication

	MPS	SD	Interpretation
Pretest	52.80	7.11	Average

Posttest	84.97	4.61	Moving Towards Mastery
Percent Increase	**32.17**		

Testing the Difference of Multiplication Skills Before and After the Innovation. Table 2 shows the test of significant difference in pupils' mathematics achievement in multiplication. Tested at 0.05 level of significance using Paired-Samples t–test, the table depicts that t - value is equal to - 19.371 with 166 degrees of freedom and a p–value of 0.001 deducing a striking significant difference in the pupils' mathematics achievement in multiplication from pretest to posttest.

Table 2: Test of Difference in Pupils' Academic Achievement in Multiplication

	Mean	**SD**	**t**	**df**	**p-value**	**Interpretation**
Pretest	15.84	7.11	- 19.371	166	0.001	Significant Difference
Posttest	25.49	4.61				

The results also emphasized that the posttest produces a mean of 25.49 and an SD of 4.61, which is undeniably higher than the pretest results with a mean of 15.84 and an SD of 7.11. This implied that the score of the pupils in the pretest was scattered away or deviated from the mean. While in the posttest, individual scores were more concentrated in the mean. The results further connote that the Multiplication Mastery Project plays a substantial part in increasing the performance of the Grade 3 pupils in multiplication.

Much evidence points to the benefits of learning outside the four walls that had increased multisensory experiences by using a variety of academic fields to teach a lesson or lessons while addressing many different learning goals (Marchant 2019). Louv (2008) also revealed that as a result of outdoor experiences, students tend to outperform students inside conventional classrooms, and academic performance increases more holistically. Gilakajani (2021) observed that many of the pupils are willing to share their ideas when solving more complex multiplication concepts without fear of incorrectly answering multiplication facts when provided with outdoor learning opportunities. This intervention suits their learning styles and needs.

The researchers developed multiplication tools that served as an intervention to meet the demands of pupils from varied educational backgrounds. Nevertheless, this work has some limitations. Due to hectic teacher's schedules, the researchers had not able to undergo validation and reliability analysis with their research tool; as a result, it is advised that future studies be planned over a longer time frame, and also, the results should be used with caution in any potential generalizations beyond the context in which the study was carried out.

Enhancement of the Innovation. When using the Multiplication Mastery Project, grade 3 pupils could explore the world firsthand and practice natural sensory learning. This helped the children understand that math is all around them while allowing them to create connections in their learning and experiences of raw materials. The researchers, therefore, recommended having a differentiated activity that will enable the learners to use their critical mathematical thinking and skills as part of their outdoor experiences. Teachers should discern the mathematical possibilities using nature's riches to discover the practical connection between the lesson towards the outdoor environment by using a multitude of 'mathematical' materials that children can genuinely get excited about.

Conclusion and Recommendations

The study results suggest that the Multiplication Mastery Project enhanced multiplication skills and accurate responses to these difficult multiplication problems. Visual analysis was accompanied by statistical analysis, which indicated that the intervention increased the multiplication skills of Grade-III pupils. The paired t-test showed a statistically significant difference between Before and After. These statistics offered proof of fluency across all issues that the differentiated activities for multiplication targeting complex problems on multiplication had enhanced multiplication skills. Survey data uncovered that the pupils observed the intervention as appropriate and effective. The results of the present investigation have practical implications, therefore, the multiplication mastery project enhanced the multiplication skills of the Grade - III pupils in Santa Lucia Central Elementary School.

Pupils will evaluate the strategies presented in this study's methodology to determine their long-term success. After a predetermined period, those who participated in this study could be contacted to check whether they kept up their development and fluency in multiplication. It is suggested that mathematics teachers use differentiated activities to meet the requirements and learning preferences of their students. To explore if individualized training could affect the learning of students who struggle with multiplication more severely, additional research could examine the effectiveness of grouping students in this situation and take the pupils' skills to a higher level. As mentioned, teaching higher-level abilities is challenging when the underlying skills need improvement. Researchers can identify which model yields the best results by gathering groups with the fundamentals down the path, after which new skills are taught in a push-in or pull-out program.

Action Plan

This Action Plan is primarily designed to maximize the involvement of Grade 3 learners in activities and innovations in the multiplication of Santa Lucia Central Elementary School, Pagadian City Division, Pagadian City. This plan highlights the process of how to carry out the Multiplication Mastery Project: An Intervention to Enhance the Multiplication Skills of the Pupils.

Key Result Area	Objectives	Strategies	Resources Needed	Person/s Responsible	Time Frame	Success Indicator
BEFORE						
Make a permit letter to conduct action research at Sta. Lucia Central Elementary School.	To ask permission from the school head.	Send letter to the school principal to grant our permit to conduct research in school.	Bond paper Ink	School Head Researchers	October 2023	Approved letter to conduct action research.
Make a test questionnaire for pretest and posttest. Orientation on the conduct of pretest in multiplication.	To measure the level of the pupils' achievement in multiplication. To ensure smooth conduct of the actual test administration. Identify students' strengths and weaknesses	Conduct pretest of the Grade 3 pupils.	Bond paper Ink Printer Laptop Personal Funds	Grade 3 learners Teachers Researchers	November 2023	Administered the pretest in multiplication smoothly. Results of pretest.

Reflection on least learned multiplication skills among Grade 3 pupils.	in multiplying numbers.					
Make an action plan and action research proposal.	✓ To develop and plan innovations that will cater the needs of Grade 3 learners in multiplying numbers.	Brainstorming of strategies and techniques by the researchers. Focus group discussion among Grade 3 classroom advisers.	Personal Funds	School Head Researchers Grade 3 teachers	November 2023	Approved action plan and list of innovations to be implemented.
DURING						
Conduct interventions and innovations for non-numerates in multiplication.	✓ To lessen Grade 3 learners who are non-numerates in multiplying numbers. ✓ To master learners in multiplying numbers. ✓ Increase the result of pretest.	Administer the following activities: 1. Multisensory Activities 2. Chanting/ Musical Chant 3. Reciting full sets as a class 4. Back-to-back (pupils using friendly competition take turns polishing their multiplication table	Beach ball Flash card Picture Worksheets Music Laptop Internet TV PowerPoint presentation	Grade 3 learners Researchers	November – February 2023	70% - 100% of the students will manifest improvement in their attitude in multiplying numbers.

		skills at the front of the classroom) 5. True or False 6. Multiplication Beach ball Toss (active and engaging and can help pupils team multi-digit number multiplications) 7. Flashing of Cards 8. Musical Chairs 9. Mystery Picture 10. Jeopardy (review game with healthy competition);				
AFTER						
Administer posttest.	To measure the level of improvement of the Grade 3 learners in multiplying numbers.	Conduct posttest.	Ink Bond paper Printer	Grade 3 learners Researchers	February 2023	The MPS will increase from 40% - 80%.

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Financial Report

The table below shows the total cost spent before, during, and after the conduct of this action research.

General Descriptions	Quantity	Unit	Unit Price	Total Estimated Cost
Short bond paper s20	6	Reams	275	1,650
Internet Cost				1000
Printing and Binding	5	Copies	60	300
Ballpen	5	Pcs	20	60
Snacks (participants)				
Ink for Printer	4	bottles	269	1,076
Total				5,000