



**EFFECTIVENESS OF SIMPLIFIED MATERIALS FOR INTERVENTION
AND LEARNING ENHANCEMENT (SMILE) OF GRADE 7
STUDENTS IN MATHEMATICS**

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ABSTRACT

This study focused on determining the effectiveness of Simplified Materials for Intervention and Learning Enhancement (SMILE) in the performance level of Grade 7 students in Mathematics. Thirty-one (31) students were the respondents of this study selected based on the result of the pre-test administration using the latest Numeracy Assessment Tool (NuMAT) - Early Grade Mathematics Assessment (EGMA) which was introduced by the Division of Rizal. The research participants were identified under the emergent numerate level adopting the standard numeracy level of learners agreed by all Education Program Supervisors in Mathematics of the region IV-A CALABARZON (Division Memorandum no. 599 s. 2022).

This employed a one group pre-test post-test experimental design. At the start of the intervention, pre-test was administered to the students which was used to compare with the post-test result after the implementation of the intervention program. The results of the pre-test and

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post-test were consolidated. T-test was used to determine the difference between the pre-test and post-test results. Mean and standard deviation were utilized to determine the average level of performance of the students before and after exposure to the developed intervention material.

The pre-test showed that out of 31 students 81% (25 students) fall under emergent level and 19% (6 students) fall under non-numerate level. While on the post-test result, out of 30 students 73% (22) fall under numerate level and 27% (8) fall under emergent level. Data results indicated a substantial difference between the test outcomes, indicating the efficacy of the SMILE of Grade 7 students in Mathematics.

The researchers planned to include the 27% of the students who were retained to emergent numerate level on the next intervention program to enhance their academic performance and raise their numeracy level. The result of the study was presented to the teachers at Jose F. Diaz Memorial National High School particularly to the math department during the LAC session. The Simplified Materials for Intervention and Learning Enhancement (SMILE) can be used to Grade 7 students this school year in the intervention class with minor revision depending on the numeracy level of the students.

Keywords: *Numeracy level, simplified intervention materials, simplified, numerate, emergent.*

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INTRODUCTION

Education is a critical factor in human capital development. It is important that it provides private returns to individuals in the form of increased productivity and higher wages, as well as social returns in terms of economic growth and achieving development outcomes for a country including reduction in mortality rates, higher life expectancy, and poverty reduction, among others.

In the Philippines, the importance of education is recognized through the pertinent provision in the 1987 Philippine Constitution stating that “The State shall protect and promote the right of all citizens to quality education at all levels and shall take appropriate steps to make such education accessible to all” (Article XIV Section 1). It should be emphasized that this provision unpacks two critical elements to education: accessibility and quality.

Two recent landmark education reforms were put in place, consistent with this overall mandate, in terms of enhancing the basic education in the country. One is the Republic Act No. 10157 otherwise known as the Kindergarten Act of 2012. It integrated the kindergarten level into the basic education, making it a prerequisite to entering the first grade of elementary. Then the Republic Act No. 10533 otherwise known as the Enhanced Basic Education Act of 2013 was passed into law on May 15, 2013, a legislation that mandated an additional two years of secondary school to augment the goals of high school education in preparation for tertiary level, vocational and technical employment opportunities. These two laws together comprise the K to 12 Basic Education Program, making the total number of years of basic education to thirteen.

The education sector in the province of Rizal has made significant improvements in achieving universal access to basic education. Specifically, net enrollment rates had increased from 95.56 percent in 2015 to the latest data of 99.42 percent as of school year 2019-2020 in

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the elementary level. In the secondary level, there were some challenges in retaining students, thus a lower net enrollment rate of 81.57 percent at this level as of 2020. Notwithstanding, this had already increased, considering that it was only 76.74 percent in 2015 (Rizal-Division Education Development Plan 2023-2028).

These numbers show a positive picture on increasing overall access to basic education in the country. Ideally, these should translate also to enhanced quality and learning outcomes.

However, some overall international and national achievement test scores showed weak performance of students. In 2018, the Philippines participated in the Program for International Student Assessment (PISA) for the first time and ranked lowest in reading comprehension, and second lowest in Math and Science, among 79 participating countries. In the 2019 Trends in International Mathematics and Science Study (TIMSS), the Philippines also ranked lowest among 58 countries included in the study.

Furthermore, Learning Outcome Assessment (LOA) conducted during the last two school years 2020-2021 and 2021-2022 revealed that among all subjects, Mathematics ranked lowest in terms of average student grades, consolidated for all Grade levels. This broader context provided a motivation for this action research. It is important that the increase in access to education in the form of enrollment rates – the “quantity” – must be accompanied by improved learning outcomes – the “quality”. By shedding light on the state of student performance, it becomes an urgent call to action for the education sector to diagnose the root causes of poor learning outcomes and design appropriate interventions to address the learning crisis.

It is worthy to recognize that in the attainment of quality education, foundational skills are imperative since they encompass the knowledge and abilities necessary to support long-term achievement. Delay on acquiring the basic skills will make it difficult for the students to achieve

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a higher level of competency. Among others, foundational skills include numeracy, literacy, and socio-emotional skills.

Literacy has traditionally been characterized as the ability to read and write (Chew 2012). Students who are unable to read effectively struggle to understand important concepts, perform poorly on tests, and ultimately fail to meet educational goals.

From UNESCO (2023), literacy is a progression of learning and expertise in reading, writing, and using numbers all through life and is part of a larger set of skills, which include digital skills, media literacy, education for sustainable development and global citizenship as well as job-specific skills. As individuals interact with information and learn through digital technology, more and more literacy skills are growing and developing.

Meanwhile, Manchester University regarded numeracy as the ability to work with numbers, including the use of mathematical formulas such as multiplication, division, ratios, and percentages. Furthermore, numeracy entails understanding how mathematics is used in the real world and being able to apply it to make the best decisions.

As mandated by the Department of Education (DepEd) in its DepEd Order No. 8 s. 2015, a student who achieves a grade of less than 75 in all learning areas must take remedial classes and pass them to advance to the next grade level. Remedial instruction or enrichment sessions should be given to students who have momentarily fallen behind in their academics or who otherwise need short-term support in their learning. These notions gave the researchers the idea to assess the effectiveness of the developed Simplified Materials for Intervention and Learning Enhancement (SMILE) in the performance level of Grade 7 students in Mathematics.

Intervention materials are highly recognized as effective tools for improving students' low academic performance. Dumigsi and Cabrella (2019) stated that before the K to 12 Basic

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Education Program was implemented, materials for intervention were highly considered as means for remediating poor achievements of the students. Subsequently, Strategic Intervention Materials (SIM) was introduced to teaching methods to revitalize the students and increase their understanding level.

MATERIALS AND METHODS

This study was decomposed into two main objectives: (i) development of learning interventions to improve student outcomes in Grade 7 mathematics; and (ii) evaluation of the effectiveness of the foregoing interventions developed by the researchers. Accordingly, the research was implemented in two phases to cover the two-pronged objective.

This study used both quantitative and qualitative methods. To assess the effectiveness of the developed intervention materials and identify the level of performance of the students, the researchers employed an experimental research approach. According to Shritika Sirisilla (2023), experimental research design is a framework of protocols and procedures created to conduct experimental research with a systematic approach using two sets of variables. It establishes a cause-effect relationship by testing a theory using experimental or control variables. This included gauging students' understanding of several topics, developing more effective teaching methods, and implementing additional plans to help students learn.

A. Participants and/or other Sources of Data and Information

This study used a purposive sampling technique. The study covered the thirty-one (31) Grade 7 students that were identified as emergent numerates using the latest NuMAT-EGMA. These students have 75% to 79% academic grade in Mathematics during the first and second quarter. Other sources of information included Math teachers at Jose F. Diaz Memorial National High School, selected math teachers of Guinayang National High School, San Mateo National High

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School, and Silangan National High School who were consulted on the design of learning materials, as well as Master Teacher, and Math consultant of the District of San Mateo. Library sources were primarily sourced online, through review of journals and relevant research papers, as well as Government data from DepEd website.

The researchers secured parents' consent of the selected participants before the intervention program was implemented. Confidentiality of the respondents' identity and information were given importance in accordance with the Data Privacy Act of 2012.

B. Data Gathering Methods

For identification of participants, a list of all Grade 7 students and their NuMAT results was sought from the school. Then this was filtered to only include those who are emergent numerates.

For the development of intervention materials, library research of previous and existing teaching materials was retrieved and modified to be incorporated in the study. Moreover, a survey was disseminated to Math teachers of all levels from Jose F. Diaz Memorial National High School, and Master Teacher of the District of San Mateo.

The survey aimed to gather insights from the teachers which served as inputs to the design of learning materials. The questionnaire was designed to elicit teachers' perceived effectiveness of specific designs of intervention materials and was semi-structured to allow for specific recommendations which the teacher may have, based on classroom experience. They were asked about (i) some background information such as the present teacher's position, their previous teaching experience i.e., length of time teaching and how much of it was spent teaching Mathematics; (ii) information on their interaction with students such as perceptions about students' preparedness in learning, their appetite for the subject which should contribute to their motivation in learning, among others; and (iii) perceptions about design of learning materials

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where some elements were proposed and the teachers were asked to rank their relative importance, and also use scales for whether some factors should be considered or not.

Survey results, and qualitative inputs from library research served as inputs to the first phase design of the learning materials, different forms such as motivational activities, groupworks, games, seat works, pop quizzes, among others were sought.

An existing mechanism, in the form of remedial classes, was utilized by the research as a venue to deploy and test the effectiveness of the intervention materials in improving the learning outcomes of the research participants. The classes were held within a period of four months, beginning from April 2023 until July 2023. At the beginning of classes, a pre-test was conducted prior to the delivery of the learning interventions. By the end, a post-test was conducted to measure any improvement in test scores.

Towards this end, surveys and consultations helped inform the development of the learning materials. These were piloted in remedial classes of all Grade 7 students that were identified as emergent numerates. Their performance was recorded before and after the piloting and was used as data inputs into the study. These were subjected to both qualitative and quantitative methods of data analysis, including measuring differences before and after the intervention, and comparison with the counterfactual when the learning interventions are not present. Further, consultations with fellow Mathematics teachers and Master Teacher supplemented interpretation of the results.

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RESULTS AND DISCUSSION

This section deals with the presentation and analysis of the results and findings of the study:

Level of the mathematical skills of grade 7 students before and after being exposed to the intervention materials as revealed in their pretest and posttest.

Table 1

Comparative Result of the Profile of Respondents' Numeracy Level based on the Pre-test and Post-test Result

Score	Pre-test		Post-test		Increase /Decrease	Numeracy Level
	f	%	f	%		
45 – 60	0	0	0	0	0	Above Numerates
30 – 44	0	0	22	73	+ 22	Numerate
15 – 29	25	81	8	27	- 17 or (- 68%)	Emergent Numerate
0 - 14	6	19	0	0	- 6 or (- 100%)	Non-Numerate
Total	31	100	30	100		
Mean	21.32	Emergent Numerate	35.40	Numerate	14.08	
SD	7.06		6.96		- 0.10	

In quantifying the numeracy level of the students, the researchers adopted the instrument of the SDO Rizal, the NuMAT-EGMA. The table showed that on the pre-test twenty-

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five (25) or 81% of the students fall under the emergent numerate level and six (6) or 19% fall under the non-numerate level. Meanwhile, the post-test result reveals that twenty-two (22) or 73% of the students fall under numerate level and 8 or 27% fall under emergent level. These numbers showed a positive increase on the numeracy level of the students. However, there were 8 students out of 25 students who belonged to the emergent numerate level. Furthermore, 100% of the non-numerates were accelerated to emergent and numerate level.

Significant difference on the performance level of the students in mathematics before and after being exposed to the intervention materials as revealed in their pretest and posttest results.

Table 2

Significant Difference on the Performance Level of the Students in Mathematics before and after Exposure to the Developed Intervention Materials

Pre-test		Post-test		Difference		n	Computed t-value	Critical t-value	Decision	Verbal Interpretation
\bar{x}_1	SD	\bar{x}_2	SD ₂	\bar{x}	SD	31	-20.80	2.042	H_o Rejected	Significant
21.32	7.06	35.40	6.96	14.08	-0.10					

The statistical computation from the pre-test ($\bar{x}_1 = 21.32, SD_1 = 7.06$) and post-test ($\bar{x}_2 = 35.40, SD_2 = 6.96$) scores before and after the implementation of SMILE in Mathematics increased. The computed t-value of -20.80 is greater than the critical value of 2.042 at 0.05 level of significance with 30 degrees of freedom. This rejected the null hypothesis. There is sufficient evidence stating that data results have a substantial difference between the test outcomes, indicating the efficacy of the intervention materials. This implied that Simplified

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Materials for Intervention and Learning Enhancement (SMILE) helped the Grade 7 students improve their numeracy skills. These findings are consistent with Cordova, et al. (2019) study on the Effectiveness of Competency-Based Strategic Intervention Materials in English 7 focusing on least mastered skills. Based on their findings there was a significant difference between the pretest and posttest scores after the utilization of the competency-based strategic intervention materials.

CONCLUSION

Findings indicated that the developed intervention materials provided students with a chance to improve their numeracy level. Result showed the improvement on the numeracy level of the students. Hence, it is concluded that SMILE is an effective intervention material to help the students raise their numeracy level. Consequently, monitoring and evaluation techniques should be employed to improve the developed simplified learning materials. In the survey conducted, it was suggested that pictures demonstrating how the answers on the examples derived should be inserted since most of the participants are visual learners. Notwithstanding, other learner types should be taken into consideration and can be an additional variable to be measured against the outcomes in a future study. Further study should be conducted using the same variable to validate present findings.

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