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Effectiveness of project COUNTS in improving students' numeracy skills

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Abstract

Students with learning difficulties benefit from intervention programs. Hence, this experimental research examined the effectiveness of Project COUNTS (Capacitating, Optimizing and Upgrading the Numeracy skills of The Students), a mathematics intervention program, and a continuous improvement venture in a public school in the Philippines during the academic year 2020–2021. It specifically investigated the numeracy skills pretest and posttest performances and its difference, and the difference in the pretest and posttest according to profiles. This experimental study utilized the data from 175 randomly selected grade 8 (91) and grade 9 (84) students under the low-numerate and non-numerate categories through multi-stage sampling. The study utilized the mean, standard deviation, dependent samples z-test, independent samples z-test, and one-way ANOVA. The results showed that the participants' numeracy skills pretest and posttest performance reached low-numerate ($\bar{x}$=15.95, SD=3.30) and numerate ($\bar{x}$=23.27, SD=3.21) levels, respectively. There is a significant difference in the participants' posttest performance when grouped according to their sex (z=2.84, p=0.00); females ($\bar{x}$=24.04, SD=3.22) have better performance than males ($\bar{x}$=22.57, SD=3.04). There was a statistically significant difference in the pretest and posttest performances (z=-11.38, p<0.001), thus confirming the intervention program's effectiveness (large effect size) in improving the numeracy skills of students. Teachers, school heads and superiors, students and parents/guardians, and future researchers can replicate or apply the intervention program to other sets of learners.

Keywords: *numeracy skills, mathematics, project COUNTS, intervention program*

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1. Introduction

Numeracy is one prerequisite fundamental skill learners need to study and develop at an early age to succeed in their higher levels of learning. According to Department of Education (DepEd) order no. 12, s. 2015, one of the predictors of a school's success is the level of a child's progress in the foundational skills, which include numeracy skills. Numeracy, the ability to understand and work with numbers, is broadly explained as the comprehensive understanding, abilities, actions, and attitudes that students must possess to effectively apply mathematical concepts in many contexts (The State Government of Victoria, Australia, 2019). Since the skill is fundamental for students, they must grasp to avoid difficulties in solving higher mathematics problems or problems relating to real-life situations that require calculation. For instance, in the context of Philippine curriculum, junior high school students should have developed their numeracy skills for them to learn easily the mathematical skills needed in senior high school, college, and even in the workplace.

In most challenged students, intervention programs, strategies to improve students' performance, are widely implemented in mathematics. For example, Mononen et al. (2014) applied early numeracy intermediations for children, Perez (2023) used numeracy station items, Clarke et al. (2018) investigated initial competence in moderating the intervention effects of ROOTS, Singh et al. (2021) explored the use of Math Zap, a card game and an academic tool for developing numeracy abilities in the setting of intellectual calculation, Frazier (2019) investigated the effectiveness of a peer tutoring intervention administered by students with autism spectrum disorder to improve the early numeracy, Layug et al. (2021) examined the interventions used by teachers to improve the numeracy skills of grade 7 students, and Wallit (2016) conducted action research on enhancing the mathematics performance of grade 6 pupils using Arts in Math (AIM).

There has been multitude of studies conducted testing specific intervention imposed on a specific scenario. While some of these studies are similar in context, the students involved were entirely different. Most researchers agree that the students' intervention program must be contextualized (Reddy et al., 2021; Johnson, 2008; Bonganciso, 2016; Nanyinza & Munsaka, 2023). For example, the division-level pretest on junior high school students at Gulod National High School (GNHS) in 2020-2021 revealed that out of 2,735 students who were tested, 584 (21.4% of the students tested) scored low in numeracy (11–20 out of 40), while 37 (1.4%) scored non-numerate (1–10 out of 40). It signifies that these students still have no strong foundations in the skills, particularly in whole numbers, fractions, decimals, and integers. Thus, with the alignment of the education or program supervisor's I-numerate project in mathematics, the GNHS mathematics teachers made plans and actions to solve this school-level problem. To contextualize the situation, the Project Capacitating, Optimizing, and Upgrading the Numeracy Skills of The Students (COUNTS), an intervention program and a continuous improvement project, aimed to develop the numeracy skills and performances of the low and non-numerate students from Grade 7 to 10. The program employs school-based intervention materials focusing on four areas, namely whole numbers, integers, decimals, and fractions, aligned to the learning competencies. The program proponents incorporated varied active teaching strategies during the application of COUNTS including the utilization of manipulative materials, Quizzizz application, reviewer with step-by-step explanation, brochures on verbal phrases to symbols, and scheduled skip counting activity via phone call/video conference in mathematics. While the participants from the previous studies include children, elementary pupils, 7^{th} graders, and students with autism spectrum disorder, the current experimental study aimed to determine effects of COUNTS on the improvement of numeracy skills of public high school students, particularly the grade 8 and 9 who belong to low-numerate and non-numerate categories.

This study desires to determine the performance in the numeracy skills pretest and posttest, compare the means in the numeracy skills pretest and posttest, bridge the gap by testing the difference in the numeracy skills pretest and posttest performances when grouped according to the participants’ sex and age, and determine the effectiveness of the intervention program by comparing the participants' pretest and posttest numeracy performances and calculating the effect size. The study is limited to 84 students in grade 9 and 91 students in grade 8, who were enrolled during 2020–2021 academic year. Since the DepEd established the MATATAG program in the Philippines, where numeracy improvement is one of the aims, the findings of this study could be fundamental inputs to the program and the department. Thus, these findings and intervention strategies can be used by elementary and high schools and can be applied even by mathematics teachers and future researchers in different divisions and regions to improve learners’ numeracy skills.

2. Literature Review

2.1. Theoretical Framework

The cognitive learning theory explains how internal and external factors influence an individual's mental processes to supplement learning (Vilamis, n. d.). Learning delays and difficulties arise when cognitive processes are affected, leading to poor numeracy skills and mathematics performance. As learning involves a substantial restructuring of existing cognitive structures, cognitive learning theory views motivation as essentially intrinsic, implying that good learning requires a significant personal commitment on the learner's part. When students are demotivated, they are unable to contribute effectively to the topic. Supportive, intrinsic, and remedial approaches are effective because they rely on students' strengths to build intrinsic motivation, and remediation is conducted in a secure atmosphere so that students can make their own interpretation of knowledge and make connections with related topics.

Further, Piaget's theory of constructivism argues that people produce knowledge and form meaning based upon their experiences (Teachnology, n. d.). This experience causes the individual to develop new outlooks, rethink what were once misunderstandings, and evaluate what is significant, ultimately altering their perceptions. This theory emphasizes that learning occurs as learners are actively involved in the process of meaning and knowledge construction rather than passively receiving information, offering students opportunities to learn important mathematical concepts and procedures with understanding. Sa'dijah et al. (2023) suggest teachers to use task-oriented learning experiences, particularly constructivist teaching methods, to improve numeracy skills of students.

In this study, cognitive learning and constructivism theories were connected since active teaching strategies were incorporated during the application of COUNTS such as utilization of manipulative materials, Quizzizz application, reviewer with step-by-step explanation, brochures on verbal phrases to symbols, and scheduled skip counting activity via phone call/video conference in teaching mathematics. These external factors would motivate and engage students in the learning process and influence an individual's mental processes resulting in an enhanced understanding of the numeracy skills.

2.2. Mathematics and Numeracy

Society's progress relies on the crucial role of mathematics, which should not be ignored. Many factors, including teaching methods, strategies, environmental factors, student motivation, and assessments, affect effective math learning. Increasing their emphasis will help students' math literacy. Recent innovations in teaching methods have not improved math achievement, which is concerning (Tan & Pagtulon-an, 2018).

Numeracy refers to the awareness, abilities, habits, and attitudes that students need to be able to use mathematics in a variety of contexts. It requires understanding mathematics' role in the world and being able to use math abilities. Most people use numbers, computation, geometry, statistics, and probability in their daily lives, research, and work. Problem solving, logic, mathematics, mathematical structure, and functions and relations help people understand the natural and human worlds and their interactions (The Department of Education and Training Melbourne, 2017). According to Tout et al. (2020), numeracy includes the knowledge, skills, attitudes, and actions pupils need in many situations. Grunau (2020), Hong et al. (2020) and Lopes (2020) found comparable results. Their research shows that adults with poor reading and math skills struggle at work, in the community, and at home. These problems include obtaining and keeping a job and helping their children with school. Hence, the significance of numeracy skills in real life in undeniable.

Layug et al. (2021) describe mathematics literacy which encompasses a comprehensive understanding and appreciation of mathematics' capabilities, rather than just complex formulas. It involves applying basic mathematical knowledge in everyday life, understanding, and combining mathematical concepts, terminologies, facts, and skills to meet real-world situations. Pitogo and Oco (2023) add that numeracy abilities are an integral part of mathematics and mastering them is essential to improving one's performance in the subject. Additionally, Guhl (2018) emphasizes the importance of early mathematics instruction for future studies, as pupils are most receptive to learning during this developmental period, especially at-risk ones, and young learners' naturally open brains are ideal for this. The researcher even emphasized that the cornerstone of all subsequent mathematics study is numeracy abilities. These skills are a more significant predictor of future success in elementary school. In addition, early math and numeracy pupils comprehend basic math ideas and numbers (Harris & Petersen, 2019). Early numeracy and math abilities are crucial for school and life math proficiency and problem-solving. Research shows that early arithmetic and numeracy training predicts future math ability (Gashaj et al., 2023; Aunio & Niemivirta, 2010; Davis-Kean et al., 2022; Braak et al., 2022) making it the best reason. Math and numeracy help should begin early because schools struggle with it.

Prior studies like Blume et al. (2021) have demonstrated that, even when domain-general abilities like working memory and IQ are considered, basic numerical abilities predict young student's progress in math. Fundamental numerical skills such as the ability to comprehend number magnitude, mathematical fact knowledge, and conceptual and procedural knowledge are important indicators of student's mathematical achievement, even after adjusting for domain-general cognitive skills.

Furthermore, numeracy is not uniform. Hirsch et al. (2018) examined the relevance of basic numerical abilities for students' mathematics grades using three operationalization; fundamental numerical skills, preparatory arithmetic skills, and informal mathematical understanding applied to numbers and counting. Brumwell and MacFarlane (2020) supported these findings, which criticize teaching numeracy as mathematics, calling it an antiquated notion. Postsecondary students may be out of practice since numeracy requires persistent practice, not simply applicable abilities. Meanwhile, Bacordo (2019) states that teaching mathematics is critical for teaching pupils' life skills. Thinking at the highest level of mental activity involves both mathematical reasoning and mental computation (Gurbz & Erdem, 2018), where a positive correlation exists between mental computation and mathematical reasoning. Mathematical reasoning is crucial in determining which mental computing method to employ. Hence, students with high mental computation levels have better mathematical reasoning.

The study of Piper et al. (2018) highlighted the value of teaching resources such as textbooks, structured guides, and professional development for teachers to improve students' reading and numeracy skills. These elements support effective lesson delivery, accommodate a variety of learning styles, and keep educators abreast of the most recent teaching approaches. Meanwhile, Indefenso and Yazon (2020) found a positive correlation between students' numeracy and financial literacy, with financial literacy rates varying directly with improved numeracy. In addition, there was a significant relationship between mathematics problem-solving and financial literacy components among junior high school students implying that numerate and good problem-solver student is also financially literate. Similarly, Wardono and Mariani (2018) found that students with high-capacity skills demonstrate better problem-solving abilities, while those with low-ability skills show significant improvement, as manifested by the low proficient students in PISA (Programme for International Student Assessment).

2.3. Numeracy Interventions

Several studies employed several numeracy interventions. According to Mononen et al. (2014), there are a variety of instructional design features, including explicit instruction, computer-assisted instruction, gameplay, and the use of concrete-representational-abstract levels in mathematical concept representations for children aged four to seven, which improved mathematics performance. Similarly, Perez (2023) found the manipulative, relevant, and interactive materials helped students' ability to work independently and accurately. For example, Clarke et al. (2018) used ROOTS, a 50-lesson mathematics intervention program aimed at strengthening whole-number ideas and skills in at-risk kindergarten pupils and found that starting skills had a moderating effect on student outcomes, but the relationship did not alter based on group size. Meanwhile, Singh et al. (2021) used Math Zap, a card game for developing numeracy skills in the context of mental computation. The study noted that while students enjoyed playing a Math Zap card game, they also improved their numeracy skills. Moreover, Frazier (2019) found peer tutoring intervention effective for students with autism spectrum disorder (ASD) to improve the early numeracy skills. The study also showed that students with ASD improved their academic skills due to participating in an educational peer tutoring intervention led by peer tutors with ASD.

According to Sa'dijah et al. (2023), teachers may use task-oriented learning experiences, such as constructivist teaching methods, to improve students' numeracy skills in Indonesia. However, teachers in the Philippines suggest different interventions. For example, Layug et al. (2021) employed conferences with parents and students, one-on-one tutorials, redoing low-score activities, home visits, supplementary materials, fewer activities, and remedial classes for Grade 7 students struggling in mathematics. The effectiveness of these strategies ranges from moderately to highly effective, aiming to close the gap between math-failing students. Lynch (2019) asserts the value of peer assessment and self-assessment although children's performance in mathematics continued to decline despite the teachers' best attempts to adopt interventions. For this, Wallit (2016) suggests the use of Arts in Math (AIM) for grade 6 students incorporating students' innate artistry with learning mathematics. While some classroom interventions are effective, several studies also emphasize that gender differences have an effect in terms of numeracy and mathematical skills development. For instance, Heyder et al. (2019) emphasized that in higher education, success in mathematics requires a certain, innate aptitude or math brilliance but detrimental to student diversity.

3. Methodology

This experimental study, which used a pretest and posttest design and only had one group (experimental only), aimed to determine the effectiveness of the intervention program, the Project COUNTS. The study used the Raosoft online calculator to determine the sample size through an experimental design. Out of the 319 population of low-numerate and non-numerate grade 8 and 9 students, there were 175 participants selected randomly through multi-stage sampling. Low-numerate students are those with scores between 11 and 20, while non-numerate students are those who obtained scores between 0 and 10 in the 40-item numeracy skills pre-assessment. By stratified random sampling technique, the participants of the study were 84 or 48% students from grade 9 and 91 or 52% students from grade 8. These students were enrolled at GNHS, Division of Cabuyao City, Laguna, in 2020–2021.

Table 1

Demographic profile of the participants

Sex	Frequency	Percentage
Male	92	52.6
Female	83	47.4
Total	**175**	**100.0**
Age	**Frequency**	**Percentage**
12 years old	3	1.7
13 years old	44	25.1
14 years old	78	44.6
15 years old	36	20.6
16 years old	12	6.9
17 years old and above	2	1.1
Total	**175**	**100.0**

Table 1 demonstrates the profile of the students in terms of sex and age with male participants (92, or 52.6%) more prevalent than females (83, or 47.4%). It also shows that the participants aged 14 are dominant in this study (78, or 44.6%). On the other hand, the least of the age groups belong to 17 years old and older (2, or 1.2%).

The study utilized the data from the results of the 40-item numeracy skills pretest and posttest administered in November 2020 and June 2021, respectively. The 40-item test was constructed and validated by the DepEd Cabuyao City Education Program Supervisor and select mathematics master teachers. The multiple-choice test includes 10 items for each numeracy skill (whole numbers, decimals, fractions, and integers). The reference scale for pretest and posttest is shown in table 2.

Table 2

The reference scale for numeracy skills pretest and posttest

Mean Range	Verbal Interpretation
31.00 – 40.00	Highly Numerate
21.00 – 30.99	Numerate
11.00 – 20.99	Low-numerate
1.00 – 10.99	Non-numerate

Source: DepEd Cabuyao City, 2021

The researchers collected the participants' demographic profile and their results on the pretest and posttest of numeracy skills conducted in 2020–2021. The pretest and posttest (Numeracy Skills pretest and posttest from the Department of Education) contain four categories, namely whole numbers, fractions, decimals, and integers, with ten questions each category aligned to the learning competencies. The researchers asked permission from the Schools Division Superintendent (SDS) and school head to utilize the pretest and posttest results on the numeracy skills of the students in 2020–2021 at GNHS. They also sought permission from the parents concerning the inclusion of their children in the program and data gathering. After approval, the researchers coded and analyzed the data for interpretation. The researchers strictly applied the data privacy act and DepEd's time-on-task policy during the program implementation and data gathering.

The implementation of Project COUNTS run from January 2021 to June 2021. The proponents performed a root-cause analysis to determine the cause and effect of the problem; thereafter, proceeded with proposing specific solutions in the intervention. Four selected teachers in mathematics created the review or intervention materials. The teachers developed that materials, which included pretests, posttests, and step-by-step explanations of how to solve problems with whole numbers, fractions, decimals, and integers. The review materials were validated by the math department's head teacher and master teachers. Each learner was categorized as low-numerate or non-numerate and was given a copy of the printed material. The students submitted their pretest and posttest outputs after a week.

Table 3 shows the intervention program matrix for the low- and non-numerates in 2020-2021.

Table 3

Project COUNTS intervention program matrix for the low- and non-numerates in AY 2020-2021

Objectives	Solutions	Activities	Persons Involved	Time Frame	Expected Outcome
1. To improve students' numeracy skills – whole numbers, fractions, decimals, and integers	Create intervention materials in a sort of reviewer	Teachers provide a step-by-step explanation in the reviewer on Whole Numbers, Fractions, Decimals, and Integers.	Head Teacher, Continuous Improvement Team, Math Teachers, Parents and Students	January to June 2021	Improved numeracy skills
2. To improve students' interest in Mathematics	Use of manipulatives in the intervention / teaching	Teachers provide manipulatives on whole numbers, fractions, decimals, and integers. Manual	Head Teacher, Continuous Improvement Team, Math Teachers, Parents, and Students	January to June 2021	Improved students' interest in Mathematics
3. To resolve students' difficulty in simplifying the order of operations	Strengthen the teaching strategy in Grouping symbols and mathematical Operations (GEMDAS)	Students will undergo a schedule for Skip Counting Activity through phone call/video conference. Quizziz will be employed for online learners. Parents will be oriented about it.	Head Teacher, Continuous Improvement Team, Math Teachers, Parents, and Students	January to June 2021	Students could simplify problems on order of operations
4. To improve students' familiarization on some Math vocabulary	Familiarize math vocabulary on translating statements into mathematical sentences	Math teachers would provide brochures (teacher-made materials) on verbal phrases to symbols.	Head Teacher, Continuous Improvement Team, Math Teachers, Parents, and Students	January to June 2021	Students got familiar with Math vocabulary

Researchers allotted a week for each competency in whole numbers, fractions, decimals, and integers to ensure a thorough understanding of each. Afterwards, they aligned the manipulative materials with whole numbers, fractions, decimals, and integers. They created fraction bars, base chips, and others so that solving problems would be simple. They also provided instructions on how to solve problems including Filipino instructions so that students would comprehend the directions in their native tongue. The learners had the manipulative materials for one week and returned them to school after use.

The mathematics teachers virtually met the learners for a skip counting activity and recitation on the multiplication tables. They also provided activities available in the Quizzes application. Afterwards, the mathematics teachers provided pamphlets on the verbal phrase translated into symbols. These were teacher-made materials created for the improvement of learners' math vocabulary. The materials have been laminated so that they will not be torn or destroyed quickly.

Mean and standard deviation were used to determine the level of numeracy skills performance in the pretest and posttest. Dependent samples z-test was used to determine the significant difference between the pretest and posttest performances of the students, and independent samples z-test to determine the significant difference in the pretest and posttest performances of the students when grouped according to their sex. One-way ANOVA was also used to determine the significant difference in the numeracy skills pretest and posttest performances of the students when grouped according to their age. Lastly, Cohen's D was used to determine the effect size of the difference between the numeracy skills pretest and posttest performances of the students.

4. Findings and Discussion

Table 4 presents the numeracy skills performance of the student participants in the pretest and posttest.

Table 4

The numeracy skills performance of the students in the pretest and posttest

Test	Mean	Standard Deviation	Interpretation
Numeracy Skills Pretest Performance	15.95	3.30	Low-numerate
Numeracy Skills Posttest Performance	23.27	3.21	Numerate

Legend: 31.00 – 40.00 highly numerate, 21.00 – 30.99 numerate, 11.00 – 20.99 low-numerate, 1.00 – 10.99 non-numerate

Based on the results, the 40-item numeracy skills pretest performance of the participants reached the "low-numerate" level *($\bar{x}$=15.95, SD=3.30)*, while the participants' numeracy skills posttest performance reached the "numerate" level *($\bar{x}$=23.27, SD=3.21)*. As seen in the table, the participants' level of numeracy skills posttest performance is greater than their pretest performance. There was an increase in the participants' posttest performance of 7.32. The result of this study is consistent with Wallit (2016) that participants' posttest performances in the first and second quarters are higher than the pretests. Hence, integrating a structured intervention program helps improve participants' posttest scores.

Table 5 shows the significant difference in the participants' pretest and posttest performances in the numeracy skills assessment grouped according to their sex. The results of the numeracy skills pretest performance show that females *($\bar{x}$=16.43, SD=3.03)*, with an interpretation level of "low-numerate", had better performance than males *($\bar{x}$=15.51, SD=3.48)*, with "low-numerate" level performance. Concerning the posttest performance, females *($\bar{x}$=24.06, SD=3.22)*, with the "numerate" level, still have better performance than males *($\bar{x}$=22.57, SD=3.04)*, with the "low-numerate" level. Similar findings were found in the study of Heyder et al. (2019) that in terms of natural math brilliance, females have stronger mathematical ideas than males.

Table 5

Test of difference in the participants' pretest and posttest performances in the numeracy skills assessment when grouped according to their sex

Sex	Mean, SD	Interpretation	z	P-value	Decision	Interpretation
Pretest						
Male	15.51±3.48	Low-numerate	-1.75	0.08	Failed to reject the null hypothesis	Not significant
Female	16.43±3.03	Low-numerate				
Posttest						
Male	22.57±3.04	Numerate	-2.84	0.00	Reject the null hypothesis	Significant at 0.01
Female	24.06±3.22	Numerate				

Legend: 31.00 – 40.00 highly numerate, 21.00 – 30.99 numerate, 11.00 – 20.99 low-numerate, 1.00 – 10.99 non-numerate

The results of the independent z-test show that there is no significant difference between the male and female numeracy skills pretest performances *($z=-1.75$, $p=0.08$).* It signifies that the numeracy skills performance of both male and female participants in the pretest does not vary. It means that pretest numeracy skills performance level of the participants was the same. In addition, there is a significant difference between the male and female numeracy skills posttest performances *($z=-2.84$, $p<0.001$).* It signifies that the numeracy skills posttest performance of the two sexes was statistically significantly different at the 1% level of significance.

Table 6 shows the significant difference in the participants' pretest and posttest performances in the numeracy skills assessment grouped according to their age. The results on the participants' numeracy skills pretest performance show that 16-year-old participants obtained the highest mean *($\bar{x}$=17.08, SD=3.55)*, with interpretation "low-numerate" level, while 13-year-old participants got the least mean *($\bar{x}$=15.52, SD=3.43)*, with interpretation "Low-numerate" level performance. On the other hand, the participants' numeracy skills posttest performance showed that 13-year-old participants obtained the highest mean *($\bar{x}$=24.16, SD=3.42)*, with interpretation "numerate" level, while 17-year-old and above participants got the least mean *($\bar{x}$=22.00, SD=0)*, with interpretation "numerate" level.

Table 6

Test of difference in the participants' pretest and posttest performances in the numeracy skills assessment when grouped according to their age

Age	Mean, SD	Interpretation	F	P-value	Decision	Interpretation
Pretest						
12 years old	16.00±0	Low-numerate	5.49	0.36	Failed to reject the null hypothesis	Not significant
13 years old	15.52±3.43	Low-numerate				
14 years old	15.56±3.43	Low-numerate				
15 years old	16.86±2.78	Low-numerate				
16 years old	17.08±3.55	Low-numerate				
17 years old and above	17.00±2.83	Low-numerate				
Posttest						
12 years old	23.00±4.36	Numerate	8.71	0.12	Failed to reject the null hypothesis	Not significant
13 years old	24.16±3.42	Numerate				
14 years old	22.87±3.04	Numerate				
15 years old	23.39±3.48	Numerate				
16 years old	22.58±2.19	Numerate				
17 years old and above	22.00±0	Numerate				

Legend: 31.00 – 40.00 Highly Numerate, 21.00 – 30.99 Numerate, 11.00 – 20.99 Low-numerate, 1.00 – 10.99 Non-numerate; Significant if $p < 0.05$

The results of the one-way ANOVA show that there is no statistically significant difference in the participants' pretest and posttest performances in the numeracy skills assessment grouped according to their age. It signifies that participants' pretest and posttest performances in numeracy skills in terms of their age do not vary *($p>0.05$)*. The study's result was supported by Kadosh et al. (2013), who found that mathematical age *($p>0.05$)* and chronological age *($p>0.05$)* did not differ across the groups. Kadosh et al. integrated the "Catch Up" intervention to increase the numerical abilities of their participants.

Table 7 presents the test of difference between the participants' pretest and posttest performances in the numeracy skills assessment. The results of the dependent z test show that there was a significant difference between the numeracy skills pretest and posttest performances of the participants *($z=-11.38$, $p<0.001$)*. Therefore, the null hypothesis was rejected. The results indicate that the intervention program—Project COUNTS—implemented by the researchers and select school mathematics teachers was effective. It was further confirmed by the effect size using Cohen's D *(2.47)* that the program's usefulness reached a large effect.

Table 7

Test of difference between the participants' pretest and posttest performances in the numeracy skills assessment

Test	Mean Difference	Effect Size (D)	z	P-value	Decision	Interpretation
Numeracy Skills Pretest and Posttest Performances	7.32	2.47 (Large)	-11.38	< 0.001	Reject the null hypothesis	Significant at 0.01

Legend: Significant if p < 0.01; 0.2=Small Effect, 0.5=Medium effect, 0.8=Large effect

The result is consistent with the findings of Mononen et al. (2014), Clarke et al. (2018), Frazier's (2019), Layug et al. (2021), Perez (2023), and Hunter et al. (2016) confirming that application of intervention program to improve numeracy skills is effective.

5. Conclusions and Recommendations

The findings revealed that the numeracy skills pretest performance showed that females had better performance than males, although they belong to the common category, which is Low-numerate level. Concerning posttest performance, females still have better performance than males. This study concluded that there was no significant difference between the male and female numeracy skills pretest performances. Hence, the null hypothesis was retained. Meaning, the numeracy skills performance of both male and female participants in the pretest was not different. Meanwhile, there was a significant difference between the male and female numeracy skills posttest performances. Thus, the null hypothesis was rejected. It signifies that the numeracy skills posttest performance of the two sexes was statistically significantly different with the application of COUNTS. Additionally, the results on the participants' numeracy skills pretest performance showed that 16-year-old participants obtained the highest mean, while 13-year-old participants got the least mean. On the other hand, the participants' numeracy skills posttest performance showed that 13-year-old participants obtained the highest mean, while 17-year-old and above participants got the least mean. The results show that there was no statistically significant difference both in the participants' pretest and posttest performances in the numeracy skills assessment grouped according to their age. So, the null hypothesis was retained. Hence, the numeracy skills of the participants remain the same regardless of age with or without the application of COUNTS. Lastly, the findings revealed that there was a significant difference between the numeracy skills pretest and posttest performances of the participants. Therefore, the study rejected the null hypothesis, indicating the effectiveness of the intervention program—Project COUNTS—implemented by the researchers and select school mathematics teachers. The researchers' implementation of the intervention program—Project COUNTS—alongside select school mathematics teachers proved to be effective. The effect of Project COUNTS was further confirmed by the result of Cohen's D for effect size, which shows that the applied program reached a large effect.

The statistically significant difference in the numeracy skills pretest and posttest performances of the learners indicates the true effectiveness of the intervention program applied by the select teachers and researchers. Thus, school heads, supervisors, and higher officers in the DepEd may consider adopting or applying Project COUNTS as an intervention program in schools to improve students' numeracy skills. Teachers may extend efforts in distributing and collecting the learners' intervention materials and outputs. They, especially the mathematics teachers, may adopt or adapt the Project COUNTS intervention program for their students with very low performances in the numeracy skills assessment. They may collaborate with or seek assistance from their co-teachers in mathematics on how to apply the intervention program to their participants.

This study is limited to the demographic profile of the respondents in terms of sex and age, and the numeracy skills pretest and posttest performance. The respondents were limited to 175 low- and non-numerate grade 8 and 9 students who were enrolled at GNHS in

2020–2021. Hence, future researchers may apply the same intervention program to different respondents and grade levels at different locales. They may expand the number of participants to validate the effectiveness of the program and include other demographic characteristics as research variables. A quasi-experimental study is also suggested if they find it hard to randomly select their respondents.

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