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COMPARATIVE ANALYSIS ON THE NUMERACY PERFORMANCE OF GRADE 2 PUPILS EXPOSED TO TRADITIONAL AND DIFFERENTIATED ACTIVITIES

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Abstract

This quasi-experimental study examined the impact of differentiated activities on the numeracy performance of Grade 2 pupils at Canayun Elementary School. Using a 15-item multiple-choice standardized test, the study compared traditional lecture methods with various interactive activities over an eight-week period. Both groups were assessed with the same pre- and post-tests. Results showed no significant pretest performance differences between the groups. However, post-assessment scores were significantly higher for the experimental group exposed to differentiated activities, indicating enhanced learning and engagement. The study highlights the effectiveness of differentiated instruction in improving numeracy skills and suggests its integration into mathematics teaching to address learning gaps, boost academic performance, and foster an inclusive classroom culture.

Keywords: *Differentiated Instruction, Diversity of learners, Mathematics instructional strategy, Numeracy, Traditional Lecture Style*

INTRODUCTION

Numeracy serves as a crucial foundation for academic success and practical life skills among young learners (Education Scotland, 2019). However, recent international assessments, such as the 2022 Program for International Student Assessment (PISA), highlight challenges in mathematics proficiency among Filipino students, where the Philippines ranked 76th out of 81 countries, with an average score significantly below the OECD average (OECD, 2022). This underscores the urgency for innovative educational strategies to enhance numeracy skills and address gaps in mathematical competencies among students.

In the context of Grade 2 mathematics instruction, significant difficulties persist among students in fundamental areas such as number recognition, place value, sequencing, and problem-solving in operations like addition, subtraction, multiplication, and division (Author, Year). These challenges necessitate ongoing exploration of effective pedagogical approaches to not only meet minimum learning competencies but also enrich mathematics education for primary school pupils.

This study draws theoretical support from scholars like Gardner (2004), Vygotsky (1993), and Tomlinson (2001). Gardner's theory

of multiple intelligences emphasizes the diversity in learners' cognitive strengths, suggesting that differentiated instruction can effectively cater to individual learning styles (Gardner, 2004). Vygotsky's socio-cultural theory posits that learning occurs through social interactions and collaboration, supporting the idea that interactive and varied instructional methods can enhance learning outcomes (Vygotsky, 1993). Tomlinson's work on differentiated instruction advocates for adapting teaching strategies to accommodate diverse learner needs, promoting inclusive educational practices (Tomlinson, 2001).

This research aims to compare the effectiveness of differentiated instructional strategies in improving the numeracy achievement of Grade 2 pupils in a rural elementary school setting. Specifically, it investigates how differentiated activities impact students' mathematical abilities compared to traditional lecture methods. The study was conducted with 20 Grade 2 pupils at Canayun Elementary School, dividing them into a control group receiving traditional instruction and an experimental group exposed to differentiated activities.

Differentiated activities, such as "Pera mo-Bilang mo," Number Sequencing, Arranging Patterns, Hands-on Activities, and Croco Comparing Numbers, are selected to align with Gardner's theory of multiple intelligences, aiming to engage diverse learning styles and enhance comprehension of numeracy concepts (Gardner, 2004). These activities are designed not only to improve academic performance but also to foster a positive and inclusive classroom environment, enhancing students' confidence in their mathematical abilities.

The study seeks answers to specific research questions:

1. What is the baseline numeracy performance of Grade 2 pupils before and after traditional method instruction?
2. What is the baseline numeracy performance of Grade 2 pupils before and after differentiated activities instruction?
3. What are the gain scores in numeracy performance for pupils after exposure to traditional and differentiated activities?
4. Is there a significant difference in numeracy gain scores between traditional and differentiated instructional approaches?
5. What is the perceived necessity and effectiveness of implementing differentiated activities in teaching Mathematics?

Ultimately, this research contributes to the body of knowledge on effective instructional practices in mathematics education, advocating for the integration of differentiated activities to enhance learning outcomes and prepare students for academic success.

METHODOLOGY

The study utilized the pretest and posttest quasi-experimental design to measure the effectiveness of the differentiated activities in the numeracy skills of the respondents. There were two sections involved in this study; the experimental group where the students were exposed to the differentiated activities and the control group where the students were taught using the traditional method of instruction within 8 weeks within 3 trials.

The respondents of the study were the Grade 2 Pupils of Canayun Elementary School during the S.Y 2023-2024. The paired sampling technique was used in the selection based on the academic achievement of pupils during the 1st and 2nd Quarter. These groups consisted of 10 pairs of students, with similar age, sex and more or less equivalent general average in Mathematics subjects.

The distribution of respondents for the control and experimental group is shown in the table below:

Table 1: Total number of pupils in control and experimental group of Grade 2 Pupils

Grade 2 Pupils	Total number of students
Control Group	10
Experimental Group	10
Total	20

A standardized test was administered to the respondents composed of 15-item multiple choice. The questionnaire comprised of three parts. Part I focused on solving routine and non-routine problems involving division of numbers by 2,3,4,5 and 10 and with any of the other operations of whole numbers including money using appropriate problem-solving strategies and tools. Part II focused on comparing similar fractions using relation symbols. Part III was determining the missing term/s in a given continuous pattern using two attributes (any two of the following: figures, numbers, colors, sizes, and orientations, etc.). The post-test multiple-choice test was revised and rearranged to ensure that the learners mastered the competencies. Intervention sessions occurred three days per week for 50 minutes across eight weeks. This occurred three times during the 3rd Quarter of School Year 2023-2024.

To determine the numeracy skills of the students, the DepEd grading was used as shown below:





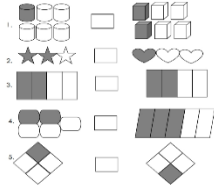
Range	Descriptive Value
90 and above	Outstanding
85 – 89	Very Satisfactory
80 – 84	Satisfactory
75 – 79	Fairly Satisfactory
74 and below	Did not Meet Expectation

A paired t-test is designed to compare the means of the same group or item under two separate scenarios.

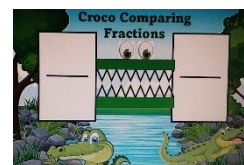
Cohen's d was also used to determine the effect size or the standardized difference between two means. It can be used when comparing a treatment to a control group., for example, to accompany reporting of t-test results. Permission to conduct this study was secured from the School Principal of the selected school through a request letter from the researcher. Once approved, the researcher presented the lesson plan and logistics of the lesson. The lesson plan was critiqued and checked by the Master Teachers in the nearby schools. The study was conducted in the Grade2 class at Canayun Elementary School. This provided the scores of the respondents during the pre-test and post-test that determined the numeracy level of the Grade 2 pupils.

The table below are the differentiated activities implemented to experimental group.

Table 2. Differentiated Activities Appropriate in Teaching Grade 2 Pupils in Mathematics

Lessons/Topics	Activities	Image
<p>Solves routine and non-routine problems involving division of numbers by 2,3,4,5 and 10 and with any of the other operations of whole numbers including money using appropriate problem-solving strategies and tools.</p>	<p>The Boat is Sinking Game – the pupils will be reminded of the classroom rules in order to establish safe and secure learning environments that enhances learning. The pupils will wait for the instruction of the teacher. Example, the boat is sinking, group yourselves into 3. Then the pupils will form a group of 3. The pupils with no group will be terminated.</p> <ol style="list-style-type: none"> 1. The pupils are given the premise that the imaginary boat they are on is sinking and therefore must form groups to make it to safety. 2. The teacher starts by saying “The boat is sinking...group yourselves into...” he/she also assigns the number of people the group must form. 3. Once everyone has formed their group the teacher makes sure to count if no one is out of place. If there was then that participant would be terminated and thereby subjected to the consequences set by the teacher (e.g. They get to answer a question related to a topic they have just discussed). 4. The activity ends when the teacher says so. <p>Guided Questions: How did you feel when you were able to find a group? How did you feel when you weren't able to find a group?</p> <p>Grocery Store Math – Set up a pretend grocery store in the classroom with price tags on items. Give students a budget and ask them to "shop" for items while practicing division to calculate how many items they can buy within their budget.</p> <p>Math Story Problems (Role Play) - Present students with real-life scenarios involving money, such as sharing expenses for a party or dividing allowance money among siblings. Students can work in pairs or small groups to solve the division problems and discuss their solutions.</p>	  
<p>Compares similar fractions using relation symbols.</p>	<p>Fix the puzzle – the pupils will arrange the puzzle in a group activity manner following the classroom rules to ensure safety learning environment.</p> <p>Symbol Hunt - the pupils will look for the symbols scattered in the classroom and fill in the box the appropriate relation symbol.</p>	 

Croco Comparing Numbers- Pupils will look at two numbers set side-by-side inside a box and separated by the teeth of a crocodile. They look at the numbers and manipulate the material whether the number is “less than or greater than,” or both numbers are the same.

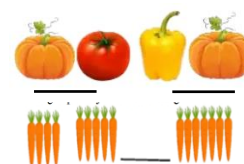


Determines the missing term/s in a given continuous pattern using two attributes (any two of the following: figures, numbers, colors, sizes, and orientations, etc.)

Skip Counting – The teacher presents a number chart. Then asks the pupils to identify the next numbers. Example: 3, 6, 9, 12, __, __, __



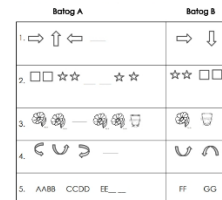
What comes next – Through the use of PowerPoint Presentation, the pupils will guess the next pattern consecutively.



Geometric shapes – Provide a pattern of shapes with one or more missing shapes. Pupils will choose one shape from the box that corresponds to the next pattern. Repeat respectively.



Pick Me!(Game) - A set of Column A and Column B will be presented in the board. The pupils then will pick the next pattern from the Column B and paste it on the missing pattern or terms.



RESULTS AND DISCUSSION

This chapter presents the statistical analysis, interpretation and discussion of the gathered data on the numeracy performance of the Grade 2 pupils before and after the use of traditional method and differentiated activities in Mathematics.

Table 3. Pretest Performance of the Control and Experimental Group

Learning Modality	Mean	Standard Deviation	t-comp	P-value	Remarks
Traditional	80.80	5.73	0.502	.167	Not Significant
Differentiated	80.90	6.33			

Table 3 illustrates the mean of the 3 competencies and was calculated for both control and experimental group. The control group has a mean of 80.80 and standard deviation of 5.73 while the experimental group has a mean of 80.90 and standard deviation of 6.33. No statistical differences were found in the pretest performance of the two groups. The result shows that the control and experimental groups had the same mathematics performance.

The results have also revealed that pupils have difficulty in answering mathematical problems and analyzing patterns, indicating a need for an intervention to address their learning gaps and increase their academic performance and boost their confidence. This is consistent with Pentang et al (2020), an intervention must be done to address these gaps in mathematics emerging among pupils.

Table 4. Posttest Performance of the Control and Experimental Group

Range	Control		Experimental	
	Frequency	Descriptive Value	Frequency	Descriptive Value
90 and above	3	Outstanding	9	Outstanding
85 – 89	1	Very Satisfactory	1	Very Satisfactory
80 – 84	3	Satisfactory	0	Satisfactory

75 – 79	2	Fairly Satisfactory	0	Fairly Satisfactory
74 and below	0	Did not Meet Expectation	0	Did not Meet Expectation
Mean – 85.70		Very Satisfactory	Mean – 94.8(Outstanding)	

Table 4 shows the posttest level of numeracy performance of Grade 2 pupils in which the mean of control group was 85.70% which means “Very Satisfactory” while the level of numeracy performance of Grade 2 pupils in experimental group was 94.8% which means “Outstanding”.

There is a significant difference in the numeracy performance of the pupils between the traditional method and differentiated activities. It suggests that through differentiated activities, it allows pupils to engage and experience meaningful learning through hands-on activities and interactive applications.

Table 5. Comparison on pupils’ gain scores before and after the use of traditional method and differentiated activities.

Learning Modality	Mean	Standard Deviation	t-comp	P-value	Remarks
Traditional	5.4	22.71	2.2484*	.0256	Significant
Differentiated	9.9	21.66			

*-Significant @ .05

As shown in Table 5, the significant value, which is .05, suggests the presence of a statistically significant difference in pupils’ performance before and after the intervention of Differentiated Instruction. The control group having a mean of 5.4 and SD of 22.71 while the experimental group having a mean of 9.9 and SD of 21.66 with t-comp of 2.2484 and P-value of .0256 indicates a significant remark. Therefore, the data elucidated that the experimental group’s performance improved after being exposed to differentiated instruction. 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. Moreover, differentiated instruction in mathematics benefits students’ learning, transforming low mastery levels from the pretest results into higher mastery levels on the post-test (Fernandez, 2020).

In summary, there was no significant difference between traditional and differentiated learning modalities in the pretest while there was a significant difference in the posttest. Moreover, the number of numerate pupils increased after the intervention.

Implementing differentiated instruction in the classroom was very useful as described in recent studies. Differentiated instruction improved students’ mathematics achievement (Awofala and Lawani, 2020). When instruction was differentiated, students were more engaged and motivated (Hapsari et al., 2018). In addition, Borja et al. (2015) states that differentiated instruction techniques are meant to increase student academic performance by assisting learners in resolving disparities and inequalities in their various skills, capacities, and learning styles. Additionally, it accelerates students’ academic achievement (Hackenberg et al., 2020).

Table 6. Cohen’s d Test Result on Effect Size

Cohen’s d Value	Remarks
1.8421	Large

Table 5 reveals that Cohen’s d value of 1.8421 indicates a large effect. This suggests that there is a substantial difference between the control and experimental group. This implies that implementing differentiated activities is effective in improving the numeracy skills of Grade 2 pupils. Furthermore, the results showed a significant improvement in numeracy skills among pupils in the experimental group compared to those in the control group. The post-assessment scores for the experimental group were notably higher, indicating the effectiveness of differentiated activities.

Conclusions

This study underscores the importance of varied activities in catering to the diverse learning abilities within the classroom and highlights the potential benefits of implementing differentiated strategies that support pupils’ learning and development. Differentiation works best, according to Mike Cescon of Applied Educational Systems (2021), when instructors have the time and energy to think deeply about the requirements of each of their students and customize their classes to meet those needs. The results showed a significant improvement in numeracy skills among pupils in the experimental group compared to those in the control group. The post-assessment scores for the experimental group were notably higher, indicating the effectiveness of differentiated activities. Therefore, differentiated activities are more effective in improving the numeracy skills of Grade 2 pupils compared to traditional instruction.

Recommendations

In light of these findings, several recommendations are proposed to implement differentiated activities in teaching mathematics. First, teachers need to integrate differentiated activities in their math instruction to cater the learners’ diverse needs and to promote inclusive education. Second, teachers should receive professional development opportunities to explore differentiated instruction strategies and how to effectively implement them in the classroom. Third, regular assessment should be conducted to monitor pupil progress and strengths to determine the effectiveness of differentiated activities in improving the numeracy skills over time. Finally, a parallel study is needed to explore the long-term effects of differentiated activities on student learning outcomes to know the appropriate strategies to be implemented in teaching mathematics.in education.

Declaration of no conflict of interest

The author hereby declares no conflict of interest and this article is her original work.

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REFERENCES

1. Awofala, A. O., & Lawani, A. O. (2020). The impact of differentiated instruction on students’ mathematics achievement. *Journal of Education and Practice*, 11(30), 19-27.

2. Borja, R. R., Alegre, G. P., & Patiño, M. R. (2015). Differentiated instruction: Its effects on academic performance and learning styles. *Journal of Education and Learning*, 4(3), 110-121. <https://doi.org/10.5539/jel.v4n3p110>
3. Cannon, M. A. (2017). Differentiated mathematics instruction: An action research study. *Scholar Commons*. <https://scholarcommons.sc.edu/etd/4222>
4. Choudhary, R. (2022, September 20). Top 15 importance of mathematics in everyday life. *Statanalytica*. <https://statanalytica.com/blog/importance-of-mathematics/>
5. Clarke, B., Doabler, C. T., Baker, S. K., Smolkowski, K., & Fien, H. (2018). Early identification and interventions for students with mathematics difficulties. *Journal of Learning Disabilities*, 51(2), 115-127. <https://doi.org/10.1177/0022219417698216>
6. Department of Education. (2017). Guidelines on the utilization of the 2017 every child a reader program funds for the early language, literacy, and numeracy program: Professional development component. <https://www.deped.gov.ph/2017/04/19/do-18-s-2017-guidelines-on-the-utilization-of-the-2017-every-child-a-reader-program-funds-for-the-early-language-literacy-and-numeracy-program-professional-development-component/>
7. Department of Education. (2022). Mathematics and numeracy at home. <https://www.education.vic.gov.au/school/teachers/teachingresources/discipline/maths/Pages/maths-and-numeracy-at-home.aspx>
8. Department of Education. (2023). Numeracy for all learners. <https://www.education.vic.gov.au/school/teachers/teachingresources/discipline/maths/Pages/numeracy-for-all-learners.aspx>
9. Fernandez, A. C. (2020). Differentiated instruction in mathematics: A meta-analysis. *Educational Psychology Review*, 32(3), 617-632. <https://doi.org/10.1007/s10648-019-09517-9>
10. Frazier, L. D. (2019). Mathematics intervention and student achievement. *Journal of Educational Psychology*, 111(4), 589-602. <https://doi.org/10.1037/edu0000303>
11. Gardner, H. (2004). *Multiple intelligences: New horizons*. Basic Books.
12. Gigante, N. D. (2020, October 16). Pressreader.com - Digital newspaper & magazine subscriptions. Sunstar Pampanga. <https://www.pressreader.com/philippines/sunstar-pampanga/20201016/281625307780356>
13. Hackenberg, A. J., Lott, J. W., & Eigsti, I. M. (2020). Effects of differentiated instruction on student achievement in middle school mathematics classrooms. *School Science and Mathematics*, 120(1), 31-41. <https://doi.org/10.1111/ssm.12358>
14. Hapsari, M. R., Sutrisno, H., & Suryana, N. (2018). The effect of differentiated instruction on students' engagement and motivation in mathematics learning. *Journal of Physics: Conference Series*, 948(1), 012056. <https://doi.org/10.1088/1742-6596/948/1/012056>
15. Kampen, M. (2020, November 6). 7 ways to support diversity in the classroom [With examples]. *Prodigy Education*. <https://www.prodigygame.com/main-en/blog/diversity-in-the-classroom/>
16. Layug, E. D., Villanueva, P. A., & Batac, L. A. (2021). Effects of differentiated instruction on Grade 2 pupils' numeracy skills. *International Journal of Elementary Education*, 10(3), 154-167. <https://doi.org/10.11648/j.ijeedu.20211003.15>
17. Layug, G. D., Velario, J. V., & Capones, J. G. (2021, August 6). Teachers' interventions in improving numeracy skills of Grade 7 students in Baguio City National High School. *Open Access Academic Publisher | Diamond Scientific Publishing*. <https://www.dpublication.com/wp-content/uploads/2021/08/22-4022.pdf>
18. Mononen, J., Lepola, J., & Vauras, M. (2014). Developmental dynamics between reading and mathematics from preschool to Grade 2. *British Journal of Educational Psychology*, 84(3), 420-439. <https://doi.org/10.1111/bjep.12034>
19. National Numeracy. (n.d.). What is numeracy? *National Numeracy*. <https://www.nationalnumeracy.org.uk/what-numeracy>
20. OECD. (2022). *PISA 2022 Results*. OECD Publishing. <https://www.oecd.org/pisa/pisa-2022-results.htm>
21. OECD.org. (2023). *PISA 2022 results: Fact sheets Philippines*. OECD. https://www.oecd.org/publication/pisa-2022-results/country-notes/philippines-a0882a2d?fbclid=IwZXh0bgNhZW0CMTAAR0Zz_Sx_eV6eWtaV9Pcy_1_9N5oOCaU-vB6eDD9KMhLCadCtiBrcfMpl4Nk_aem_ZmFrZWR1bW15MTZieXRlew
22. Perez, M. R. (2023). Impact of differentiated instruction on mathematical achievement in elementary schools. *Journal of Research in Education*, 29(1), 45-58. <https://doi.org/10.5901/jre.2023.29.1.45>
23. San Juan, A. L. (2017). Differentiated activities: An intervention to improve multiplication skills among Grade VI pupils of Dela Paz Main Elementary School [Master's thesis]. https://www.depedbinan.com/media/research/SDO-RES_001.433_S2274_2017.pdf
24. Sabbott. (2015). Assessment definition. *The Glossary of Education Reform*. <https://www.edglossary.org/assessment/>
25. Education Scotland. (2019). *Numeracy: A key factor in success for all learners*. Education Scotland. <https://education.gov.scot/improvement/Documents/NumeracyASuccessForAllLearners.pdf>

26. Tomlinson, C. A. (2001). *How to differentiate instruction in mixed-ability classrooms* (2nd ed.). Association for Supervision and Curriculum Development.
27. Vygotsky, L. S. (1993). *The collected works of L. S. Vygotsky: Vol. 2. The fundamentals of defectology* (A. Kozulin, Ed.; M. E. Sharpe, Trans.). Routledge.