

Sequential Learning Activity: Effect on the Performance of Grade 5 Pupils in Dividing Fractions

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Date received: November 8, 2024

Date revised: November 26, 2024

Date accepted: December 12, 2024

Originality: 96%

Grammarly Score: 99%

Similarity: 4%

Recommended citation:

Espiritu, M., Vendicacion, E. (2024). Sequential learning activity: Effect on the performance of grade 5 pupils in dividing fractions. *Journal of Interdisciplinary Perspectives*, 3(1), 60-66. <https://doi.org/10.69569/jip.2024.0611>

Abstract. This study aimed to determine the effectiveness of Sequential Learning Activity as an intervention material to improve the performance of Grade 5 pupils in dividing fractions at Lias Elementary School for the School Year 2022-2023. The study utilized a quasi-experimental design, specifically the one-group pretest-posttest involving 27 pupils whose scores are categorized as "Does Not Meet Expectation" based on the result of the Diagnostic Test given. The pupil-respondents were exposed to the intervention material (Sequential Learning Activities) that offered lessons and activities ranging from the most basic, which serve as the prerequisite skill, progressing to more complex concepts leading to mastery of division of fractions. The study revealed that there was a significant improvement in the pupils' scores in dividing fractions after they were exposed to the intervention, as manifested in the associated p-value of .000, which is less than alpha .05, and in the increase of pretest and posttest mean scores of 2.74 and 7.33, respectively. In light of the findings, the researchers recommended that the use of Sequential Learning Activities developed as an intervention material can help pupils understand the step-by-step process of how to divide fractions effectively. The findings suggested specific implications that can affect learners' division skills. From the gathered related studies, it has been suggested that the agreeable attitude of the pupils when it comes to using the intervention material (SLA) in developing division skills may influence their performance in Dividing Fractions. As a result, they become more focused on division activities. Furthermore, the use of sequential learning as a strategy not only in teaching Mathematics but in other learning areas as well is highly recommended as it ensures that the prerequisite skill and fundamental knowledge will be fully acquired before moving forward to other lessons with increasing complexity to achieve mastery of the knowledge and skills taught.

Keywords: Division; Fractions; Intervention materials; Sequential learning.

1.0 Introduction

Pupils learn in a sequential process. Learning the fundamentals is essential to develop a higher proficiency level. Pupils should be capable of solving more manageable tasks and problems before presenting the difficult ones. Thus, some preliminary skills should be learned before learning complex ones (Chen et al., 2015). Moreover, failure to acquire basic skills in any field of knowledge may pose significant challenges, affecting learners' success in class and future endeavors.

This is also the underlying notion of the spiral progression approach to learning, which begins with the basic facts of knowledge and progresses upward until a rich breadth of knowledge and abilities is attained. The spiral

progression approach in the K-12 curriculum is derived from Bruner's model, wherein learners should repeatedly experience a diverse range of concepts or disciplines with increasing complexity to master the knowledge and skills taught.

More so, the 2018 Program for International Assessment (PISA) worldwide study proved that Filipino learners elicit worrying signs of an education crisis. In Math, Filipino students around 15 ranked second to the lowest among the 79 participating countries. Another international test, the 2019 Trends in International Mathematics and Science Study (TIMSS), revealed that Grade 4 Filipino learners obtained the lowest scores in Math and Science among 58 countries involved in the study. Therefore, it is urgent to address issues and gaps in the country's attainment of quality primary education, particularly in math, science, and reading.

The sudden leap from the two-year blended and modular distance learning to effective implementation of face-to-face instruction for the current school year has brought enormous challenges in the education sector. There is a need to address learning gaps to meet the required essential learning competencies and compensate for the backlog of years learners could not attend in-person classes as part of the Learning Recovery and Continuity Plan (LRCP) as stipulated in the DepEd Order No. 34, s. In 2022, schools will be highly encouraged to focus on learning intervention and remediation.

Therefore, teachers shall continue to provide interventions to the learners, especially the most vulnerable ones, in acquiescence with the DepEd Order No. 8, s. 2015. Interventions include instructional materials, learning materials, facilities, equipment, and teaching programs. Hence, teachers need to prepare materials that the learners can utilize to provide meaningful academic opportunities to them. In connection with the serious problems learners encounter in coping with mathematics topics, teachers need to use meaningful and appropriate instructional materials as shored up by the instructional theory.

In their early years, elementary pupils are expected to acquire confidence and a practical understanding of the four basic arithmetical operations- addition, subtraction, multiplication, and division. However, the arithmetical operation that appears to be the most difficult to learn is division, with children having difficulty with this arithmetical operation and, in some cases, having no understanding of it at all (Cawley et al., Ehlert et al., & Robinson et al.). The study mentioned above substantiated the results of the Diagnostic Test in Math given among Grade 5 pupils of Lias Elementary School, Marilao South District, for the school year 2022-2023, which revealed that 27 out of 222 learners got 74% and below of the required level of proficiency as mandated in the DepEd Order No. 31, s. 2012. Their level of proficiency is categorized as beginning, which means that the prerequisite skill and fundamental knowledge have not been acquired.

For this reason, this action research aimed to improve the performance of Grade 5 pupils in the division of fractions by using Sequential Learning Activities as learning intervention material. The material focused on the division of fractions, which is the identified least learned skill based on the Diagnostic Test in Mathematics result and is aligned with the Most Essential Learning Competencies required for Grade 5 pupils. It is designed to cater to pupils struggling to perform division skills by presenting a systematic and logical process of dividing numbers. It helped learners master this skill in a step-by-step manner. More so, it covered three levels- starting from the basic and progressing to a more difficult one.

The Sequential Learning Activities intervention material entailed a detailed guide on how to divide each given fraction, and the catch was, as the level moves forward, the activities progress from the easiest and simplest way to learn the skill until the learners can perform it independently. The process relied on rote memorization and mastery of this basic operation. Through this technique, learners found it easier to break division problems into more manageable steps. By doing those steps, they solved various problems and understood numbers more deeply. Therefore, it is a powerful procedure through which pen and paper division can be carried out.

The study of Chiu & Hong (2019) focused on a single classroom setting, limiting the generalizability of the findings. It did not account for long-term retention of the skills learned or variations in student demographics, which could affect outcomes. Students engaged in sequential teaching strategies exhibited improved understanding and problem-solving skills in fraction division.

Bottino and Chiappini (2020) suggested integrating digital tools in sequential learning to improve conceptual understanding and provide immediate feedback. Moreover, Huang & Wang 2021 believed that a structured, sequential learning model significantly enhanced students' proficiency in fraction operations, especially division. While numerous materials are available, the researchers believed that the learning intervention material that they developed would help improve the quality of Mathematics teaching so that no learner will be left behind, especially during this time when pupils experience the transition from two-year modular distance learning back to face-to-face instruction.

2.0 Methodology

2.1 Research Design

The study's primary objective was to evaluate the effectiveness of the intervention (Sequential Learning Activities) in improving the Grade V pupils' performance in dividing fractions. A one-group, pretest, and posttest quasi-experimental research design was used. Because this design is perfectly aligned with the study's objectives, the researchers chose to utilize it. Of the 222 Grade 5 pupils, 27 need intervention in developing their skills in dividing fractions. The researchers determined its effectiveness on how this (Sequential Learning Activities) may help the learners improve their poor skills in dividing fractions.

2.2 Research Locale

This study was conducted in Lias Elementary School, Marilao, Bulacan. It comprises 27 Grade 5 pupils who got 74% and below the required level of proficiency as mandated in the DepEd Order No. 31, s. 2012. This is based on the result of the diagnostic test given during the second week of September at Lias Elementary School, Marilao South District, Schools Division of Bulacan, for the S.Y. 2022- 2023. As the design and purpose of diagnostic tests are formative, these test results provide a glance at the baseline data on Learners' knowledge concerning the standard competencies based on competence standards as well as denoting learners' level of prior knowledge and mastery over relevant prerequisite/enabling competencies/skills taught in the immediately preceding grade level about competencies and skills from what they have been provided exposure covering through learning process during earlier grades.

As seen from the previous RDA data, as a result of analyzing the RDA data, there are significant areas of learning loss across subjects at the grade 6 level, which had been carried up since the prior grade based on what should have taken place in last year and this particularly is seen in mathematics for the learners at Bunducan Elementary School. This is something that has to be addressed immediately. It can even multiply the probability of a learner encountering learning horizons if overlooked. The respondents came from the five Grade Five sections: Earth, Mercury, Jupiter, Venus, and Mars. The sections from which the participants came are heterogeneously classified, establishing a diverse range of gender, race, economic status, numeracy, and literacy levels of the learners. The researchers recognized that the limitations of the study's conclusions cannot be used to extrapolate the findings of other studies, as outcomes may differ due to sample restrictions and adjustment of the study's target timeframe.

2.3 Research Participants

The study's respondents were 27 Grade 5 learners from the total population of 222 enrolled fifth graders, who got 74% and below the total number of items in the Diagnostic Test in Math administered among them. The said criteria are based on the required level of proficiency as mandated in the DepEd Order No. 31, s. 2012 wherein pupils' level of proficiency and equivalent numerical value were categorized as follows: beginning (74% and below), developing (75- 79%), approaching proficiency (80- 84%), proficient (85-89%), and advanced (90% and above). The sections from which the participants came are heterogeneously classified, establishing a diverse range of gender, race, economic status, numeracy, and literacy levels of the learners.

2.4 Research Instrument

In this action research, Sequential Learning Activities were used as intervention material to improve the performance of the Grade 5 pupils in dividing fractions for the school year 2022- 2023 to help the pupils cope with the learning gaps in their mathematical abilities and prepare them for more difficult mathematical concepts that they will encounter in the future were among the researchers' guiding principles for this study.

The intervention material offered lessons and activities ranging from the most basic, which are the prerequisite skills, progressing to more difficult concepts, leading to mastery. It is composed of five lessons as follows: (1) Parts of Division Sentence, (2) Kinds of Fractions, (3) Simplifying Fractions, (4) Getting the Reciprocal, and (5) Division of Fractions. The latter part is composed of several sub-topics highlighting the material, such as the division of fractions by whole numbers, the division of whole numbers by fractions, and the division of proper fractions. Each topic is supplemented with activities to apply the concepts learned and check to understand. However, before introducing pupils to the intervention material, the researchers sought help from other Math teachers to check the material.

Additionally, to quality assure and improve the material developed, it underwent evaluation both at the school and district level by the quality assurance team of the LRMDs using the evaluation form and field-testing tool used by the LRMDs of the Schools Division of Bulacan in validating different learning materials. This tool comprises 144 total points where evaluators scored the resource material using a 4-point Likert scale (4 – Very satisfactory, 3- Satisfactory, 2- poor, 1- Not satisfactory). Factors evaluated in the material include content, format, presentation and organization, and accuracy and up-to-date information.

After the approval, a designated place and time were set to facilitate the intervention using face-to-face instructional interaction, ensuring the safety of each learner. During the remediation process, the following process was observed: Each of the Grade 5 pupil-participants was given material that served as their guide during the instruction and answer sheets on which they wrote their answers for each activity. All parts of the intervention material were taught to the learners.

To assess the Grade 5 pupils' skills in dividing fractions, a pretest and posttest patterned after the Division-wide Unified First Quarterly Assessment Test was administered. The 10-item multiple choice test was where pupils were challenged to compute and solve the given numbers or questions focusing on the identified competency. There was no time limit in answering the given test since the researchers intended to measure their performance in dividing fractions correctly and not their ability to solve with speed. The following data was used to determine whether there is a significant effect on their performance. Furthermore, the researchers ensured that each respondent received and utilized the intervention material prepared to attain the desired outcomes. Also, all the pupils' outputs concerning the study were compiled in their portfolios.

2.5 Data Gathering Procedure

To ensure the safety of the learners, strict implementation of public health protocols due to the COVID-19 pandemic was strictly observed in adherence to the Department of Education, Regional Memorandum No. 228, s. 2020. Before submitting the research proposal to the Division Office for checking and approval, a letter of intent was submitted to the school and district office asking permission to conduct the study. The intervention material underwent school and district validation using the evaluation form and field-testing tool used by the LRMDs of the Schools Division of Bulacan to validate different learning materials. This tool comprises 144 total points, where evaluators scored the resource material using a 4-point Likert scale (4 – Very satisfactory, 3 – Satisfactory, 2 – Poor, 1 – Not satisfactory). Factors evaluated in the material include content, format, presentation and organization, accuracy, and up-to-date information.

After the Division Office approved the research proposal, the preparation and implementation of the study were pushed through, starting with the distribution of assent and consent forms for respondents to ask permission from their parents for their involvement in the study. When parents had already consented to the pupils being involved in the study, they were given an orientation to explain the intervention properly. Then, a pretest was given to evaluate the pupils' performance level in dividing fractions before the study. Meanwhile, after the intervention's implementation, a posttest was provided to determine if there were significant differences in pupils' pretest and posttest scores. Also, it served as the basis for determining if the proposed intervention significantly affected the pupils' performance in the division of fractions. A pretest and posttest were administered to assess the Grade 5 pupils' skills in dividing fractions. The 10-item multiple choice test was where pupils were challenged to compute and solve the given numbers or questions focusing on the identified competency. There was no time limit in answering the given test since the researchers intended to measure their performance in dividing fractions correctly and not their ability to solve with speed. The following data was used to determine whether there is a

significant effect on their performance. The researchers tabulated, organized, analyzed, and interpreted the data gathered. Following the Data Privacy Act of 2012, the researchers ensured that the standards set by the research ethics were followed. Thus, the data collected was kept confidential and used only for research purposes. Lastly, the conclusion and recommendations for the study's significant beneficiaries were disseminated based on the findings.

2.6 Ethical Considerations

The study followed the stated ethical standards on the adherence to research principles and responsibilities in different studies that involve teaching-related, non-teaching personnel, and learners as stated in the DepEd Order No. 16 s. 2017 entitled Research Management Guidelines, also known as Republic Act No. 10173, as "Data Privacy Act of 2012". Furthermore, the researchers were sensitive to the need to consider, respect, and safeguard the well-being of vulnerable participants, and the confidentiality of the information of the participants was followed, kept, and secured properly. The confidentiality of data and privacy of the participants during all the transactions, transmission, storage, and destruction of data will be handled considering the ethical standards in adherence to Regional Memorandum no. 228, s. 2020.

3.0 Results and Discussion

Table 1 shows the performance level of grade 5 pupils in dividing fractions before the intervention. It further reveals that the level of understanding of Grade 5 pupils in dividing fractions is very low, as evidenced by the number of pupils who failed (24) the pretest. This shows that the respondents have a wide learning gap in Mathematics since one of the four essential basic math operations, division, was not fully mastered.

Table 1. The performance level of before the intervention

Scores	Equivalence	Pretest
10	Excellent	0
8-9	Very Good	0
7	Good	0
6	Satisfactory	0
5	Passing	3
4 and below	Failed	24

This is incongruent with the study of Deringöl (2019); a lack of understanding of fractions ideas among the impacted students may be the primary cause of their low performance in fractions calculations. The study found that some phrases, such as equivalent, numerator, and quotient, were given colloquial meanings instead of technical ones. Some phrases were mistakenly thought to imply the same mathematical action, which may have confused them. Some terms were mistaken for their inverses in mathematics.

Table 2 presents the performance level of grade 5 pupils in dividing fractions after the intervention. The table shows that 24 learners passed the exam. Three of them obtained a perfect score. Thirteen respondents got a score of 8-9 (Very Good), three got 7 (Good), three scored 6 (Satisfactory), and two received a score of 5 (Passing). This demonstrates that the effort to conduct intervention may bridge pupils' learning gaps.

Table 2. Performance level after the intervention

Scores	Equivalence	Posttest
10	Excellent	3
8-9	Very Good	13
7	Good	3
6	Satisfactory	3
5	Passing	2
4 and below	Failed	3

However, three out of 27 respondents got a failing score (4 and below). To address this emerging problem, these three remaining respondents underwent one-on-one tutorial sessions to improve their skills. During the one-on-one tutorial session with the three respondents who failed to pass the given posttest, it was found that all had difficulties multiplying numbers, resulting in difficulties in dividing fractions. Because of this unforeseen event in the research process, the researchers decided to create an intervention material about the multiplication of numbers and the multiplication of fractions until these three respondents successfully passed and met the required

passing mark in the posttest. This is in line with the study of Ubah (2021), which reveals that when teaching fractions, teachers' understanding and capacity to draw links between representations and their flexibility in switching between different types of representations are critical to students' performance.

Table 3 presents the mean and standard deviation of the pretest and posttest scores of Grade 5 pupils. The pretest score's mean and standard deviation are 2.74 and 1.509, respectively, while the posttest score's mean and standard deviation are 7.3333 and 1.90142, respectively. This further implies that the respondents improved their division skills in fractions. The intervention material used also played a significant role in developing and improving the skills of the grade 5 respondents. After implementing the intervention material, the respondents' pretest and posttest scores were compared and analyzed using a t-test.

Table 3. Mean and standard deviation of post-test of the respondents

	Minimum	Maximum	Mean	Std. Deviation
Pretest	0	5	2.74	1.509
Posttest	3.00	10.00	7.33	1.901
Valid N (listwise)				

Recent studies have emphasized the significance of structured learning pathways in mathematics education. In the study of Rukundwa et al. (2021), teaching division – especially with fractions – sequentially increased student performance and comprehension by enabling them to build on their prior knowledge.

Table 4 shows the difference between the learners' pretest and posttest results after implementing the intervention material. It can be deduced from the table that at 0.05 significance level, the p-value is .000. This clearly shows that the results of the pretest and the posttest were significantly different in favor of the posttest, as manifested in the obtained mean and p-value. Furthermore, it was concluded that there was a significant improvement in the pupils' scores after exposure to the intervention. Moreover, the result implies that the intervention material (SLA) can significantly help increase the participants' interest in dealing with competency in Mathematics, particularly in dividing fractions.

Table 4. Test of difference between the pretest and post-test of the participants

	Mean	Std. Deviation	Alpha	P-Value	Statistical Inference
Pre-test	2.74	1.509			
Posttest	7.33	1.901	0.05	.000	Significant

In general, if properly structured and presented, the learners can understand even the most complex lesson if there is a sequential and logical progression from simple to complex ideas that will help them strengthen their skills (Johnston, 2012). This is also in consonance with a recent analysis by Barak and Keren (2020), where scaffolding improves students' understanding of difficult subjects like fraction division. They discovered that guided discovery strategies can greatly enhance student outcomes by giving students the support they need to solve problems.

4.0 Conclusion

Teachers must utilize the Sequential Learning Activities developed as intervention material in Mathematics to improve the pupils' division skills. These activities can help learners understand the step-by-step process of dividing fractions effectively and clearly. Sequential Learning is highly recommended as a strategy not only in teaching Mathematics but also in other learning areas. It ensures that the prerequisite skills and fundamental knowledge are fully acquired before moving forward to other lessons with increasing complexity to achieve mastery of the knowledge and skills taught.

Teachers must assess the level of the learners and consider their needs and interests in planning and developing learning intervention materials to guarantee their success and effectiveness. Likewise, teachers are encouraged to prepare and produce learning materials to cater to the needs of high-quality education and transform the pupils' learning deficiencies into great learning opportunities. Therefore, it was manifested that the pupils' skills in connection to the division of fractions had greatly improved using the locally produced intervention material – sequential Learning Activities. This method is found to be effective since preliminary skills and fundamentals are tackled first before moving forward to more complicated and challenging tasks and activities.

5.0 Contributions of Authors

The researchers have shared an equal distribution of tasks to develop this study. It was also reviewed by some experts in the fields, presented to a research festival, and approved by the research evaluation committee of the Schools Division of Bulacan.

6.0 Funding

This study has not received any funding grant from any agency.

7.0 Conflict of Interests

The researchers declare no conflicts of interest about the publication of this paper.

8.0 Acknowledgment

The researchers would like to thank Dr. Gracia DC. Viudez for her unwavering support in implementing the study, the respondents and their parents for their active participation in the study, the Members of the Research Committee of SDO Bulacan headed by Ma'am Maribel S. Perez, Senior Education Program Specialist in Planning and Research, and the source of everything, the Almighty Father.

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