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THE USE OF THE CUISENAIRE RODS APP AS A TOOL FOR LEARNING DISSIMILAR FRACTIONS IN GRADE 6 MATHEMATICS

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ABSTRACT

This study determined the effect of the Cuisenaire Rods app on Grade 6 learners' performance in dissimilar fractions at Catigbian Central Elementary School, Poblacion, Catigbian, Bohol, during the school year 2025–2026. An explanatory sequential mixed-methods design was used. The quantitative phase involved 45 Grade 6 learners in a one-group pretest–posttest design, while the qualitative phase involved one-on-one interviews with 10 selected participants. A researcher-made proficiency test measured four competencies: simplifying fractions, identifying equivalent fractions, adding dissimilar fractions, and subtracting dissimilar fractions. Results showed that the overall mean score increased from 71 in the pretest to 77 in the posttest. The proportion of learners at the Advanced level increased from 2% to 20%. Significant differences were found between pretest and posttest scores in simplifying fractions ($t = -8.21$, $p = 0.0019$), identifying equivalency ($t = -8.22$, $p = 0.001$), adding dissimilar fractions ($t = -7.20$, $p = 0.004$), and subtracting dissimilar fractions ($t = -7.70$, $p = 0.009$). Qualitative findings revealed three advantages of the app: improved understanding of fractions, development of skills and personal growth, and increased motivation and engagement in learning. Reported challenges included visual clarity and focus issues, and a lack of mastery in using the app due to technical responsiveness concerns. The study concludes that the Cuisenaire Rods app is a promising supplementary tool for teaching dissimilar fractions, although sustained exposure, teacher guidance, and technical support remain necessary.

KEYWORDS: *Cuisenaire Rods App, Dissimilar Fractions, Grade 6 Mathematics, Digital Manipulatives, Pretest, Posttest*

1. INTRODUCTION

Understanding fractions is foundational in elementary mathematics, yet it remains one of the most difficult areas for many learners. Fraction learning becomes especially challenging when learners must simplify fractions, identify equivalent fractions, and perform operations involving unlike denominators. Prior studies have shown that weak conceptual foundations and overreliance on procedural teaching contribute to persistent learner errors in fraction work (Guler & Tarim, 2024; Hurrell, 2021; Lenz & Wittmann, 2021).

Among Grade 6 learners, adding and subtracting dissimilar fractions is particularly demanding because it requires prior understanding of equivalence, common denominators, and flexible representation of parts of a whole. When these prerequisite skills are weak, learners often commit errors in both reasoning and computation. Research has also noted that visual and manipulative supports are important in addressing misconceptions in fraction learning (Abreu-Mendoza et al., 2022; Wulandari & Amir, 2022; Makhubele, 2021).

One instructional response is the use of manipulatives. Cuisenaire rods have long been used to represent numerical relationships concretely, and their digital counterparts can extend this experience through interactive visual exploration. Digital manipulatives may help learners move from concrete and pictorial understanding toward symbolic reasoning while also increasing engagement during instruction (Adom & Adu, 2020; Tadeu, 2023; Siller & Ahmad, 2024).

In the local context of Catigbian Central Elementary School, low mathematics performance and weak early assessment results suggested the need for an intervention focused on specific fraction competencies. Although several studies have examined virtual manipulatives and fraction apps, limited local evidence exists on the use of the Cuisenaire Rods app with elementary learners in Bohol, particularly in relation to simplifying fractions, identifying equivalency, and adding and subtracting dissimilar fractions. There is also limited context-based evidence on how learners perceive the app's strengths and limitations in actual classroom use.

Anchored in constructivist perspectives associated with Piaget and Bruner, this study examined whether the Cuisenaire Rods app could support stronger conceptual understanding and better performance in dissimilar fractions among Grade 6 learners. The study also explored learner perceptions to generate practical instructional implications for classroom use.

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2. OBJECTIVES

2.1 determine the pretest and posttest performance of the participants in simplifying fractions, identifying equivalency, adding dissimilar fractions, and subtracting dissimilar fractions;
2.2 determine the overall pretest and posttest performance of the participants across the four learning competencies;
2.3 test whether significant differences exist between the participants' pretest and posttest performance in the four learning competencies;
2.4 describe the performance-level shifts observed from pretest to posttest;
2.5 identify the perceived advantages and disadvantages of using the Cuisenaire Rods app; and
2.6 derive classroom implications for the use of the app in teaching fractions.

3. METHODOLOGY

The study used an explanatory sequential mixed-methods design. The first phase was quantitative and employed a one-group pretest–posttest quasi-experimental design to examine changes in learner performance before and after the intervention. The second phase was qualitative and used one-on-one interviews to explain and enrich the quantitative findings.

A researcher-made 40-item proficiency test, aligned with the Grade 6 mathematics competencies for the first quarter, served as the main quantitative instrument. The test covered simplifying fractions, identifying equivalent fractions, adding dissimilar fractions, and subtracting dissimilar fractions. Content validation was conducted by experts in mathematics education, and pilot testing was done prior to the main study. A semi-structured interview guide was used for the qualitative phase.

After the necessary approvals and consent procedures, the participants took the pretest. The intervention was then implemented through structured learning sessions using the Cuisenaire Rods app. After the intervention, the same set of competencies was measured through a posttest of equivalent scope and difficulty. Interview data were subsequently gathered from selected learners to document perceived advantages and disadvantages of the app.

4. SAMPLING DESIGN

The study involved 45 Grade 6 learners from two regular sections of Catigbian Central Elementary School during the school year 2025–2026. The participants were selected purposively through total inclusion of eligible learners in the two sections, excluding transferees in order to maintain consistency of prior instructional exposure.

For the qualitative phase, 10 learners were selected from the same cohort to represent varied performance levels and learning experiences. These participants provided deeper insights into how the app supported or constrained their learning.

5. STATISTICAL DESIGN

Descriptive statistics, specifically frequency, percentage, and mean, were used to summarize learner performance and performance-level distributions. A paired-samples t-test at the 0.05 level of significance was used to test differences between pretest and posttest scores for each learning competency.

The qualitative data were analyzed thematically to identify recurring patterns in learner experiences. The themes were then used to explain the strengths and limitations of the intervention from the learners' perspective.

6. GEOGRAPHICAL AREA

The study was conducted at Catigbian Central Elementary School, Poblacion, Catigbian, Bohol. The school has an upgraded computer laboratory, which enabled the implementation of app-based learning sessions. The site was appropriate for the study because it provided the infrastructure needed for guided digital learning activities in mathematics.

7. RESULTS

Before the intervention, learner performance across the four competencies was generally low. The dominant performance level in the pretest was Beginning, indicating weak foundational understanding of fraction concepts and operations. The weakest areas were adding and subtracting dissimilar fractions, where most learners scored below 75.

After the intervention, the distribution of scores shifted upward. The overall mean increased from 71 in the pretest to 77 in the posttest. The proportion of learners at the Advanced level also increased from 2% to 20%, while the proportion at the Beginning level decreased from 73% to 58%. Although many learners still require additional support, the movement toward higher performance categories indicates meaningful learning gains.
The gains were statistically significant across all four learning competencies. Simplifying fractions improved from a mean of 4.7 to 6.3 ($t = -8.21$, $p = 0.0019$), identifying equivalency improved from 4.7 to 6.3 ($t = -8.22$, $p = 0.001$), adding dissimilar fractions improved from 4.1 to 5.8 ($t = -7.20$, $p = 0.004$), and subtracting dissimilar fractions improved from 3.4 to 4.9 ($t = -7.70$, $p = 0.009$). These results suggest that the app supported better conceptualization and procedural performance within the study group.

Performance-level shifts also showed that simplifying fractions and identifying equivalency reflected the most visible movement into higher categories, while adding and subtracting dissimilar fractions remained challenging despite improvement. This pattern suggests that strengthening prerequisite fraction concepts may be essential before learners can fully master more complex operations involving unlike denominators.

The qualitative findings supported the statistical results. Three major advantages emerged from learner interviews: improved understanding of fractions, skill development, and increased

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motivation and engagement in learning. Learners reported that the app made common denominators and fraction comparison easier to understand, encouraged exploration and learning through mistakes, and made mathematics more enjoyable.

Two major challenges also emerged. First, some learners experienced visual clarity and focus issues, especially during the early stages of app use. Second, some participants reported lack of mastery in using the app because of technical responsiveness issues. These findings indicate that the app can be beneficial, but orientation, repeated exposure, and technical readiness are necessary for smoother classroom use.

8. SUGGESTIONS

8.1 Teachers may sustain the use of the Cuisenaire Rods app as a supplementary instructional tool, particularly for introducing fraction concepts that benefit from visual representation.
8.2 Additional remedial and guided practice sessions may be provided for adding and subtracting dissimilar fractions, since these remained the most difficult competencies even after the intervention.
8.3 Schools may support implementation through teacher training, technical orientation for learners, and routine checking of equipment to minimize delays and screen-response problems.
8.4 Lesson planning may combine the app with discussion, questioning, and follow-up exercises so that digital manipulation is connected to symbolic reasoning and independent practice.

9. CONCLUSION

The study showed that the Cuisenaire Rods app was associated with improved performance in dissimilar fraction competencies among Grade 6 learners at Catigbian Central Elementary School. Significant gains were observed in all four competencies, and the qualitative data showed that learners found the app helpful, engaging, and supportive of conceptual understanding. However, the persistence of Beginning-level performance among many learners, along with reported technical and visual difficulties, indicate that the app should be treated as a guided supplementary tool rather than a stand-alone solution.

10. AREA FOR FURTHER RESEARCH

Future studies may use a larger sample, include a control or comparison group, and extend the intervention period to determine whether longer exposure produces stronger mastery. Researchers may also examine how the app performs in other grade levels, in other mathematics topics, or in blended combinations with physical manipulatives and teacher-developed lesson designs.

11. TABLES AND REFERENCES

Table 1. Overall Pretest and Posttest Performance of the Participants

Performance Level	Pretest f (%)	Posttest f (%)
Advanced	1 (2)	9 (20)
Proficient	1 (2)	1 (2)
Approaching Proficiency	3 (7)	4 (9)
Developing	7 (16)	5 (11)
Beginning	33 (73)	26 (58)
Mean	71	77

Table 2. Difference Between the Participants' Pretest and Posttest Performance in the Four Learning Competencies

Learning Competency	Pretest Mean	Posttest Mean	Mean Difference	t-value	p-value	Interpretation
Simplifying Fractions	4.7	6.3	1.6	-8.21	0.0019	Significant
Identifying Equivalency	4.7	6.3	1.6	-8.22	0.001	Significant
Adding Dissimilar Fractions	4.1	5.8	1.7	-7.20	0.004	Significant
Subtracting Dissimilar Fractions	3.4	4.9	1.5	-7.70	0.009	Significant

Table 3. Summary of Observed Performance-Level Shifts

Learning Competency	Pretest Dominant Level	Posttest Dominant Level	Observed Shift
Simplifying Fractions	Beginning	Beginning to Advanced	Clear upward movement, with more learners reaching upper levels
Identifying Equivalency	Beginning	Beginning to Advanced	Moderate to substantial improvement across levels
Adding Dissimilar Fractions	Beginning	Beginning to Advanced	Reduction in very low scores, but low-level performance still present

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Subtracting Dissimilar Fractions	Beginning	Predominantly Beginning with emerging higher levels	Improvement evident, though many learners remained at the lowest level
Overall	Beginning	Mostly Beginning with learners progressing upward	General upward variance indicating learning gains but not yet universal mastery

Table 4. Qualitative Themes on the Use of the Cuisenaire Rods App

Category	Main Theme	Brief Description
Advantage	Improved learners' understanding of fractions	The app helped learners understand common denominators, fraction comparison, and other foundational concepts through visual representation.
Advantage	Development of skills and personal growth	The app encouraged exploration, trial and error, collaboration, patience, and confidence in solving fraction tasks.
Advantage	Increased motivation and engagement in learning	Learners described the app as enjoyable and motivating, making fraction learning feel more interactive and less intimidating.
Disadvantage	Challenges in visual clarity and focus during learning	Some learners became confused by the display, rod values, or screen presentation, especially at the start of the intervention.
Disadvantage	Lack of mastery in using the app due to technical responsiveness issues	Slow or inconsistent screen response and limited familiarity with the app affected confidence and continuity during tasks.

REFERENCES

1. *Abreu-Mendoza, R., Coulanges, L., Ali, K., et al. (2022). From non-symbolic to symbolic proportions and back: A Cuisenaire rod proportional reasoning intervention enhances continuous proportional reasoning skills.*
2. *Adom, G., & Adu, E. O. (2020). The use of Cuisenaire rods on learners' performance in fractions in Grade 9 in public high schools in Chris Hani West District, South Africa.*
3. *Al-Barakat, A. A., AlAli, R. M., Al-Hassan, O. M., et al. (2025). Enhancing math skills in children with learning difficulties using smartphone apps.*
4. *Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101.*
5. *Campbell, D. T., & Stanley, J. C. (1963). Experimental and quasi-experimental designs for research.*
6. *Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.).*
7. *Fitriyani, F. (2024). Utilization of Cuisenaire rods in enhancing mathematical achievement in fractions at the elementary school.*
8. *Guler, N. K., & Tarim, K. (2024). An analysis of classification skills of Grade 6 students on fractions.*
9. *Hurrell, D. P. (2021). Conceptual knowledge or procedural knowledge or conceptual knowledge and procedural knowledge: Why the conjunction is important for teachers. Australian Journal of Teacher Education, 46(2).*
10. *Lenz, K., & Wittmann, G. (2021). Individual differences in conceptual and procedural fraction knowledge: What makes the difference and what does it look like? International Electronic Journal of Mathematics Education, 16(1), em0615.*
11. *Makhubele, Y. E. (2021). The analysis of Grade 8 fractions errors displayed by learners due to deficient mastery of prerequisite concepts.*
12. *Parungao, R. C. (2021). Manipulative approach in teaching fractions.*
13. *Siller, H. S., & Ahmad, S. (2024). The effect of concrete and virtual manipulative blended instruction on mathematical achievement for elementary school students.*
14. *Tadeu, P. J. A. (2023). A synopsis of the importance of teaching fractions to children until K–10.*
15. *Versoza, D. M., De Las Peñas, M. L. N., Aberin, M. L. Q., et al. (2022). Development of an app and videos to support the fraction learning trajectory from Grades 1–7.*
16. *Wulandari, D., & Amir, M. F. (2022). Analysis of elementary school students' difficulties in fraction addition.*