

Addressing Challenges in Simplifying Complex Fractions with Fundamental Operation: Foundations for Designing an Intervention Program

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ABSTRACT

The purpose of this study was to determine the Challenges Encountered by Grade-10 students in Simplifying Complex Fractions Involving Fundamental Operations. This study utilized the descriptive research design and made use of the researcher's self-made questionnaire of fifteen (15) items. The researchers come up with twenty (20) respondents out of twenty-three (23) students. Using frequency, percentage, weighted mean, and t-test for correlated means. The results of the study were able to answer the statement of the problem, especially in question number three (3). The results of this study show that using the intervention program, scores were able to improve regarding simplifying complex fractions. By using the t-test, the scores show that there is a significant difference in the difficulties encountered by the respondents in simplifying complex fractions.

Keywords: Complex Fraction, Fundamental Operation, Intervention Program

INTRODUCTION

“Mathematics is not just about numbers, equations, computations, or algorithms, it is about the deeper understanding and analyzation.” – from an anonymous. Mathematics is said to be one of the hardest subjects according to Jules (2003). An anonymous author, once said “Just because something is difficult doesn’t mean you shouldn’t try, it just means that you should try harder.” Bishnoi (2016), stated that most of the students do not like mathematics as a subject because the learners are having difficulties in understanding and analyzing mathematics problem. On the other hand, according to Willingham (2013), only few students find mathematics as a challenging situation and that serves as their intrinsic motivation to love math.

Mathematics is a methodical application of matter. It is so said because the subject makes a man methodical or systematic. Mathematics makes our life orderly and prevents chaos. However, there is a common knowledge that Mathematics creates fear among many students.

One of the areas in Mathematics where students find less interesting is the complex fraction. According to Hale (2012), a complex fraction is a fraction in which the numerator or the denominator both contain one or more fractions. Problems involving fractions would require one to know what numerators and denominators are. Sometimes, students consider complex fractions as “stacked” fractions, because they tend to have fractions stacked on top of each other.

Mathematics concepts, such as fractions, that students have not mastered in early grades can confuse them later, especially in their senior years in high school or even in their early years in college. This research assumes of the researchers that math concepts involving complex fractions which are supposed to be mastered by students in high school might not still be fully grasped thereby causing many students to dislike math.

Teaching Mathematics, especially complex fractions, is quite challenging but, what is more challenging is when teachers encounter students who hate Mathematics. They have to spend a longer time teaching such a particular concept to focus on the students to make them understand the concept well.

Pal (2009) concluded that children’s difficulties in learning are rooted in the lack of understanding of lower-level concepts and lack of clarity about different rules that are often conflicting and can lead to misconceptions and affect mathematical learning. Most students are having a hard time simplifying complex fractions because some students are not familiar with the fundamentals and the sequence of solving them.

The researchers would like to know whether the Grade 10 students encounter problems in simplifying complex fractions with fundamental operations. The data that the researchers may gather will be helpful to understand the students better and upgrade their learning strategies.

Research Question

1. What challenges do Grade 10 students face when they are answering the pre-test questionnaires by simplifying complex fractions that involve fundamental fractions?
2. What is the preferred instructional method among students for simplifying complex fractions with fundamental operations?
3. Is there a significant difference in the difficulties encountered by the respondents in simplifying complex fractions before and after the implementation of current teaching methods?
4. What intervention programs may be proposed based on the findings of the study?

Hypothesis

There is no significant difference in the mean performance scores of Grade 10 students in simplifying complex fractions using fundamental operations before and after the implementation of the current teaching methods.

METHODOLOGY

Teaching and problem-solving in mathematics are integral components of a student's education, fostering critical thinking, logical reasoning, and analytical skills. Mathematics is not just a set of rules and

formulas; it is a dynamic and creative discipline that encourages students to explore and solve real-world problems.

In the context of grade 10 students, a descriptive design study would involve systematically collecting and analyzing data to gain insights into the issues they face. This research could encompass various aspects such as academic performance, social dynamics, extracurricular involvement, and personal challenges.

Through surveys, interviews, and observations, researchers aim to paint a comprehensive picture of the challenges encountered by grade 10 students. The findings of such a study can be valuable for educators, policymakers, and stakeholders in developing targeted interventions to support students during this critical phase of their education.

The researchers chose the Grade 10 students of International Christian Academy as the respondents of this study. The data collection was conducted in the Fourth Estate Subdivision, Parañaque City, Philippines. As a result, the suggested sampling is completely voluntary, and each responder has provided permission for the survey of questions to be conducted. A total of about twenty (20) students responded to this survey. Teachers teaching Mathematics were also involved in the data collection.

To successfully accomplish the objective of the study, the Researchers asked: approval and consent from the Principal Office. Distribution of pretest and post test questionnaires was given to the students and checked from the office of the Principal. The data gathered were tabulated, analyzed and interpreted carefully. The examination of hypotheses utilizes the Two Paired T-Test, chosen for its appropriateness in comparing means within a paired sample design.

RESULTS

1. What challenges do Grade 10 students face when simplifying complex fractions that involve fundamental fractions?

Pretest:

Challenge faced by Students in solving fractions (Pretest)								
Indicators	1 = easy ; 2 = little difficulty; 3 = moderately difficult; 4 = very difficult				Total	Mean	SD	Verbal Interpretation
Topics	1	2	3	4				
Addition of simple similar fractions	12	3	3	2	20	1.75	1.32	Easy
Addition of simple dissimilar fractions	2	9	6	3	20	2.5	1.58	Little difficulty
Addition of simple dissimilar fractions with mixed number	4	5	8	3	20	2.5	1.58	Little difficulty
Subtraction of simple similar fractions	14	0	5	1	20	1.65	1.28	Easy

Addition and subtraction of simple dissimilar fractions	7	9	4	0	20	1.85	1.36	Little difficulty
Addition and subtraction of simple dissimilar fractions	8	3	9	0	20	2.05	1.43	Little difficulty
Multiplication of simple similar fractions	10	2	8	0	20	1.9	1.38	Little difficulty
Multiplication of simple dissimilar fractions with unlike signs	10	4	6	0	20	1.8	1.34	Little difficulty
Multiplication of dissimilar mixed number	7	7	6	0	20	1.95	1.40	Little difficulty
Division of simple similar fractions	10	5	5	0	20	1.75	1.32	Little difficulty
Division of simple dissimilar fractions	8	5	7	0	20	1.95	1.40	Little difficulty
Division of dissimilar mixed number with unlike signs	6	4	10	0	20	2.2	1.48	Little difficulty
Division of complex fractions involving addition and subtraction	5	7	6	2	20	2.25	1.50	Little difficulty
Division of complex fractions involving addition and subtraction	6	5	8	1	20	2.2	1.48	Little difficulty

Division of complex fractions involving addition and subtraction	5	5	9	1	20	2.3	1.52	Little difficulty
General Weighted Mean						2.04	1.43	Little difficulty

Post Test:

Challenge faced by Students in solving fractions (Post test)								
Indicators	1 = Easy ; 2 = Little difficulty; 3 = Moderate difficulty; 4 = High difficulty							
Topics	1	2	3	4	Total	Mean	SD	Verbal Interpretation
Addition of simple similar fractions	12	3	4	1	20	1.70	1.30	Easy
Addition of simple dissimilar fractions	9	5	5	1	20	1.90	1.38	Little difficulty
Addition of simple dissimilar fractions with mixed number	7	3	8	2	20	2.25	1.50	Little difficulty
Subtraction of simple similar fractions	14	2	3	1	20	1.55	1.24	Easy
Addition and subtraction of simple dissimilar fractions	6	7	6	1	20	2.10	1.45	Little difficulty
Addition and subtraction of simple dissimilar fractions	8	4	7	1	20	2.05	1.43	Little difficulty
Multiplication of simple similar fractions	12	4	3	1	20	1.65	1.28	Easy
Multiplication of simple dissimilar fractions with unlike signs	10	6	4	0	20	1.70	1.30	Easy
Multiplication of dissimilar mixed number	8	5	6	1	20	2.00	1.41	Little difficulty
Division of simple similar fractions	9	8	2	1	20	1.75	1.32	Easy
Division of dissimilar mixed number with unlike signs	6	6	7	1	20	2.15	1.47	Little difficulty
Division of complex fractions involving addition and subtraction	5	9	5	1	20	2.10	1.45	Little difficulty
Division of complex fractions involving addition and subtraction	4	10	5	1	20	2.15	1.47	Little difficulty
Division of complex fractions involving addition and subtraction	3	8	8	1	20	2.35	1.53	Little difficulty
General Weighted Mean						1.94	1.39	Easy

2. What is the preferred instructional method among students for simplifying complex fractions with fundamental operations?

Instructional Method	TOTAL	RANK
Gamification	17.5	3rd
Use of Visual Aids	12.5	
Manipulation Tools	23.33	1st
Pair Work	14.17	
One on One	18.33	2nd
Real Life Examples	10.83	
Others	3.33	

3. Is there a significant difference in the difficulties encountered by the respondents in simplifying complex fractions before and after the implementation of current teaching methods?

t-Test: Two-Sample Assuming Equal Variances		
	<i>Pretest</i>	<i>Post Test</i>
Mean	4.55	4.35
Variance	18.89210526	16.23947368
Observations	20	20
Pooled Variance	17.56578947	
Hypothesized Mean Difference	0	
df	38	
t Stat	0.150902404	
P(T<=t) one-tail	0.440425466	
t Critical one-tail	1.68595446	
P(T<=t) two-tail	0.880850931	
t Critical two-tail	2.024394164	

DISCUSSION

The highest mean, indicating the most challenging aspect is, is observed in the addition of simple fractions and the addition of simple dissimilar fractions with mixed numbers, both with a rating of 2.50. This suggest that the students found these operations comparatively more difficult than others.

On the other hand, the lowest mean is associated with subtraction of simple similar fractions. This implies that students, on average faced little difficulty within this particular operation during pre-test.

The subtraction of simple fraction has relatively lower SD of 1.28, indicating less variability in student performance for this operation. Conversely, the highest SD with addition of simple fractions and the addition of simple dissimilar fractions with mixed numbers. This suggests a greater variability in student scores, indicating a wider range of proficiency levels and potential challenges in this area.

In summary, the data highlights specific areas of difficulty for students in solving fractions during the pre-test, with variation in both mean rating and standard deviation providing insights into the overall performance and consistency across different operations with a grand weighted mean of 2.04.

The operation with the highest mean is the division of complex fractions involving addition and subtraction, with a mean rating of 2.35. This suggests that students found this operation to be relatively more challenging compared to others.

The lowest mean is associated with the subtraction of simple similar fractions, indicating that students, on average, faced less difficulty with the specific operation during the post-test.

The subtraction of simple similar fractions also has the lowest SD of 1.24. This indicated a lower variability in student performance for this operation, suggesting a more consistent level of proficiency among the students. The division of complex fractions involving addition and subtraction has the highest SD of 1.53. This implied a greater variability in student scores for this operation, indicating a wider range of proficiency level potential challenges.

The general weighted mean across all operations is 1.94. This provides an overall average rating of the difficulty students faced in solving during the post-test.

In Summary, the post-test data highlight variations in the difficulty levels of different fraction-solving operations, with specific emphasis on challenges associated with the division of complex fractions involving addition and subtraction.

Manipulation tools are identified as the most preferred instructional method, with a score of 23.33. This suggests that students favor learning through hands-on activities and tangible materials to enhance their understanding of fraction operations.

One-on-one instruction is the second most preferred method, receiving a score of 18.33. This indicates that students value individualized and personalizes interaction with educators as an effective approach to learning fraction approach.

Gamification is ranked third among students' preferred instructional methods, with a score of 17.5. This implies that incorporating game elements and interactive elements into the learning process is appealing to students when it comes to understanding fraction operations.

The ranking order provides valuable insights into the instructional method that resonates most with students. Manipulation tools, one-on-one, and gamification emerge as the top three preferences, offering educators guidance in tailoring teaching strategies to enhance students' engagement and comprehension of fraction concepts involving fundamental operations.

The Grade 10 Pre-test has a higher mean rating of 4.55 than the Grade 10 Post Test with a rating of 4.35. But it also shows that the Grade 10 Post Test was more consistent with a standard deviation (SD) of 2.09

than the Grade 10 Pre-test with a rating of 2.13. The researcher failed to reject the H_0 since the computed t-value was 0.15 less than the critical value of 1.6860. Failure to reject the H_0 means there is no significant difference between the pretest and post-test using a 5% level of significance.

CONCLUSION

The study indicates a shift in the most challenging fraction operations for students from the pretest to the post-test. During the pre-test, addition with simple fractions and addition of simple dissimilar fractions emerged as the primary challenges. However, in the post-test, the focus of difficulty shifted towards the division of complex fractions involving addition and subtraction. This suggests a dynamic learning process where students encounter varying levels of difficulty in different stages of mastering fraction concepts. It reveals that students express a strong preference for certain instructional methods. Manipulation tools, one-on-one, and gamification emerged as the top three preferred approaches. These findings underscore the importance of incorporating diverse and engaging teaching strategies that involve hands-on activities, personalized interactions, and elements of gamification to enhance student's overall learning experience and comprehension of instructional content. It is a noteworthy disparity in the effectiveness of current teaching methods in simplifying complex fractions. The observed significant difference underscores the need for reevaluation of instructional approaches to enhance students' proficiency in mastering this mathematical concept.

RECOMMENDATION

Based on the findings and conclusion, the following are hereby recommended:

1. The teacher may utilize the results of this study for the improvement of the students in simplifying complex fractions involving fundamental operations.
2. Integrate interactive tools and technology into the curriculum to engage students actively in the process of simplifying complex fractions, promoting a hands-on learning experience.
3. Encourage collaborative learning environments where students can work together to solve basic to complex fractions problems, fostering peer-to-peer support and understanding.
4. Future researchers may conduct follow-up research about problems encountered by Grade-10 students in solving complex fractions involving fundamental operations

ETHICAL CONSIDERATION

Privacy and confidentiality

All information acquired remained anonymous and the outcome of the research study remains confidential. The questionnaires and survey forms were stored in a flash drive to which only the researchers had access. All the information gathered during the research will be used for research purposes only. All the accumulated data will be deleted immediately after completing the research. Outcomes of the study may be published in academic journals and may be cited by other researchers performing homogenous studies rest assured that the respondent's personal information will be kept confidential.

Risk and Safety

There have been no risks in the fulfillment of the research and the researchers assured that the respondents were safe and were not harmed while conducting the study, this is to assure that the study will last only

for a week. All the questionnaires and survey forms were conducted through online platforms using the provided university e-mail to assure the legitimacy and safety of the respondents.

Voluntarism

The researchers maintained the integrity of the paper and were open in answering truthfully the inquiries and questions of the respondents about the implementation of the research study before signing the consent form. If the respondents would like to request to withdraw from responding to the study, the researchers were considerate to let them withdraw at any phase of the research study.

Benefits

The study does not have direct benefits to the respondents as of writing, however, the respondents' insights and narratives regarding the research topic may contribute to the research study of the researchers which may in turn supplement and enrich the simplifying complex fractions with fundamental fractions: foundations for designing an intervention program to which the respondents may benefit in the future.

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