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A Study on Difficulty in Understanding the Concept of Fractions among 7th Standard Students'

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ABSRACT

This action research investigates the challenges faced by 7th standard students in understanding fractions and evaluates the effectiveness of activity-based instructional strategies in improving their conceptual learning. The study was motivated by common difficulties such as misconceptions about fraction size, confusion between numerator and denominator, weak visualization skills and limited real-life connections. A purposive sample of five students from Rotary West School, Mysore, who scored below 10 in the pre-test, was selected. Using a one-group pre-test and post-test experimental design, the researcher implemented four interventions: chart-based explanation, real-life demonstrations, ICT-supported instruction and hands-on activities involving fraction strips, paper folding, number lines and digital tools. Analysis of post-test results revealed significant improvement in student performance, indicating that visual, concrete and technology-integrated strategies effectively enhanced students' conceptual understanding of fractions. The study concludes that meaningful, activity-oriented teaching approaches help reduce misconceptions and strengthen foundational mathematical skills.

***Keywords*:** Fractions, Misconceptions, Activity-Based Learning, Visual Learning Strategies.

Introduction:

Mathematics is an important subject that helps students develop logical thinking, problem-solving skills and understanding of numbers. One of the key topics in mathematics is fractions, which students learn from the upper primary classes. Fractions are used in many areas of maths such as decimals, percentages, ratios and even in algebra. They also appear often in real life like when we share food, measure ingredients, or divide objects into equal parts.

Even though fractions are so useful, many 7th standard students find them difficult to understand. A major reason is that students are comfortable working with whole numbers, but fractions are different because they represent parts of a whole. Many children try to use whole-number rules while comparing or calculating fractions, which leads to confusion. For example, some think that a fraction with a bigger denominator must be bigger, or they compare fractions only by looking at the numbers, not by understanding their actual values. These misunderstandings make it hard to learn operations like addition, subtraction, multiplication and division of fractions.

Need and Importance of the Study:

Understanding fractions is a critical part of the middle-school mathematics curriculum, forming the foundation for advanced topics like rational numbers, percentages, algebra and problem-solving. Many 7th standard students struggle due to misconceptions, weak visualization and limited connections to real-life contexts. Investigating these difficulties is essential for identifying learning gaps early and preventing cumulative errors. The study provides valuable insights for teachers to design activity-based, visual and remedial strategies that enhance conceptual understanding, strengthen mathematical thinking and promote meaningful learning of fractions.

Statement of the Problem:

The study aims to identify difficulties 7th standard students face in understanding fractions. Misconceptions, limited conceptual understanding, procedural teaching and lack of visual models or real-life contexts hinder learning. The research seeks to pinpoint areas of confusion and examine instructional and cognitive factors affecting fraction comprehension.

Objectives of the Study:

1. To identify the level of understanding of fraction among 7th standard students.
2. To analyse the factors contributing to students difficulty in understanding fractions.
3. To develop pedagogical strategies to facilitate students to understand fractions early.
4. To implement the pedagogical strategies among 7th students.
5. To evaluate the effectiveness of the implemented strategies.
6. To enlist suitable research-based suggestions of the educators for making ease of fractions in the instructional process.

Causes of the Problem:

1. **Whole-Number Thinking:** Many 7th standard students think about fractions the same way they think about whole numbers. For example: They believe 7 is bigger than 5, so they also think 1/7 must be bigger than 1/5.This wrong idea comes from treating fractions like whole numbers, which confuses them when comparing fraction sizes.
2. **Misconception about fraction size:** Students often think a bigger denominator means a bigger fraction. But actually, the bigger the denominator, the smaller the fraction (e.g., 1/8 is smaller than 1/4). Because students do not clearly understand that the denominator shows how many equal parts the whole is divided into, they get confused about fraction size.
3. **Confusion between Numerator and Denominator**: Students mix up the roles of numerator and denominator. Common misconceptions: “If the numerator is bigger, the fraction is always bigger” and “If the denominator is bigger, the fraction is always smaller”. They fail to see that fraction size depends on both numbers together, not separately.

4. **Difficulty Visualizing Fractions:** Many students cannot picture fractions in their mind. Without using number lines, fraction circles, or area models, students cannot properly judge which fraction is bigger or smaller. This leads to confusion such as: Thinking 3/10 is larger than 1/2 because "3 is bigger than 1."
5. **Lack of Real-Life Examples:** Students often learn rules, but not meaning. If fractions are not connected to real situations like sharing food, measuring, or dividing objects-students do not understand what the fraction really represents. This makes them memorize instead of understand, causing mistakes in comparing fractions.
6. **Difficulty Understanding Fraction as a Number:** Students struggle to see fractions as numbers on a number line. They think fractions are separate from whole numbers instead of being between them. Because of this, they cannot understand: Why 1/2 is less than 3/4 and why fractions can be compared using the number line.
7. **Students Struggle to Understand Fractions as Measures:** Students often see fractions as symbols (1/2, 3/4) but fail to understand them as quantities that can be measured. Because of this, they find it hard to compare fractions or judge which is larger. Example: Students think 2/6 and 1/3 are different because they "look different," even though they represent the same size.
8. **Lack of Number-Line Experience:** Many classrooms use only circles or bars, but students rarely learn fractions on a number line. This creates confusion because they do not see fractions as positions on a continuous scale.
9. **Difficulty Understanding Unit Fractions (1/n):** Students often do not understand that the size of the pieces gets smaller when the denominator increases. Without mastering unit fractions, comparing and adding fractions becomes very confusing.
10. **Difficulty Moving from Concrete to Abstract:** Many students can understand fractions using objects (pizza, shapes, sticks), but when fractions appear in numbers or word problems, they become confused. They cannot transfer the idea from hands-on learning to symbolic learning.

Prioritized Causes:

1. Misconception about fraction size.
2. Confusion between Numerator and Denominator.
3. Difficulty Visualizing Fractions.
4. Lack of Real-Life Examples.
5. Students Struggle to Understand Fractions as Measures.
6. Difficulty Moving from Concrete to Abstract.

Review of Related Literature:

Siegler, Robert S. and Pyke, Alibali C. (2013), in their study *Development of Fraction Understanding among School Children* published in the *Journal of Educational Psychology*, examined how students acquire basic fraction concepts and found that middle-grade learners often rely heavily on whole-number thinking. This results in persistent errors when comparing and operating on fractions. Their work highlighted that many students misinterpret fraction size because they fail to shift from whole-number reasoning to rational-number reasoning. They emphasized that instruction using visual models, number lines and hands-on manipulative supports deeper conceptual understanding and enhances fraction learning in middle school.

Lamon, Susan J. (2012), in her book *Students Understanding of Fractions: A Research-Based Approach* published by Routledge, explained that students often understand fractions only as parts of a whole rather than as numbers on a continuum. Her research emphasized that true conceptual learning occurs when teachers use multiple representations such as area models, set models and real-life contexts. Lamon also stressed that when students experience fractions in varied situations, they develop flexible thinking and richer mathematical understanding. Her findings showed that encouraging students to discuss and justify their reasoning significantly improves their conceptual grasp.

Tzur, Ron and Simon, Martin A. (2004), in their article *Children's Construction of Fractions and Their Schemes* published in the *Journal for Research in Mathematics Education (JRME)*, investigated how children develop fraction understanding through constructive learning schemes. Their study found that children learn fractions more effectively when engaged in guided activities involving measurement, sharing and meaningful contexts. They also concluded that conceptual development improves when students are given opportunities to explore ideas and construct meaning through discovery-based learning. Tzur and Simon argued that supportive classroom environments that promote exploration and reflection are essential for building strong fraction concepts.

Behr, Merlyn; Harel, Guershon; Post, Thomas; and Lesh, Richard (1992), in their chapter *Rational Number Concepts in Children* published in the book *Analysis of Arithmetic for Mathematics Teaching* by Lawrence Erlbaum Associates, examined the cognitive challenges students face in rational-number learning. They found that children often confuse the numerator and denominator roles, struggle with equivalence and rely on superficial features instead of conceptual meaning. Their research emphasized that symbolic instruction alone is insufficient and that concrete models, manipulatives and hands-on experiences are essential for building rational-number understanding.

Streefland, Leen (1991), in his book *Realistic Mathematics Education and Fractions Learning* published by Kluwer Academic Publishers, emphasized that fractions should be taught in meaningful, real-life contexts to promote deeper learning. His findings showed that traditional rote methods limit students' conceptual growth and weaken confidence in mathematics. Streefland demonstrated that when students work with realistic problems involving sharing, measuring and everyday situations, they develop stronger reasoning and better fraction understanding. His work supports the use of realistic mathematics education to make learning engaging, contextual and effective.

Research Methodology:

The method adopt for this action research is **quantitative research method** and employed **experimental research design** i.e., one group pre-test and post-test design.

Population: The population for this study is focus on 7th Standard Students of Rotary west school, located in Saraswatipuram, Mysore.

Sampling: Purposive sampling technique was adopted with a criteria of - student who were facing difficulty in understanding the concept of fractions who scored less (below 10) marks in pre-test conducted by the researcher.

Sample Size: The size of the sample is 5 students.

Research Tool: Researcher developed pre-test and post-test questionnaire consisting of objective types, short answers questions of 25 marks.

Procedure:

1. **Pre-Test:** A test was conducted to check the student existing knowledge about the concept fractions.
2. **Analyse Pre-Test Results:** The results showed that many students are facing difficulties in understanding the concept of fraction and its size.
3. **Action Plan:** Planning four activities that helpful to understand the concept of fractions.
4. **Implement the Action Plan:** The activities were carried out within 20 minutes.
5. **Post-Test:** A same test was conducted for the same students to compare the students learning after the intervention.
6. **Result Analysis:** The post-test results showed the improvement in the score and effectiveness of the action plan.

Action Plan:

Table-1: Details of Action Plan

Sl. No.	Activities name	Duration	Frequency
1	Chart based activity to understand fractions.	20 minutes	2 in a week
2	Real life demonstration of whole and part.	15 minutes	1 in a week
3	Understanding proper and improper fraction through ICT tools	20 minutes	2 in a week
4	Use of fractions strips, pie model, number lines and digital tools.	25 minutes	2 in a week

Description of Action Plan:

Activity 1: Chart based activity to understand fractions.

In this activity, the researcher used a chart to explain the concept of fractions to 7th standard students. The chart included the definition of fractions and several examples. In each example, the top part of the numerical fraction was represented as the numerator and the bottom part as the denominator. The researcher explained each example in detail and involved students by asking them to identify numerators and denominators. This visual method helped students easily understand the parts of a fraction and reduced their difficulty in solving fraction problems.

Activity 2: Real life demonstration of whole and part.

In this activity, the researcher used real-life examples like pizza cuts and chocolates to explain the concept of whole and part. Students observed how a whole pizza or a full chocolate bar can be divided into equal pieces to represent fractions. The researcher explained that the entire object represents the whole, while each piece represents a part. Students actively participated by identifying and comparing the parts. This simple and visual method helped them understand the concept of fractions clearly and with interest.

Activity 3: Understanding Proper and Improper Fractions through ICT Tools

In this activity, the researcher used ICT tools to explain the difference between proper and improper fractions. Images and visual slides were shown to help students observe how fractions can represent parts of a whole or more than a whole. The researcher explained each example clearly using digital visuals to make the concept easier to grasp. Students identified and classified fractions as proper or improper based on the images shown. This use of technology made learning more engaging and effective.

Activity 4: clearing misconceptions through paper folding activity:

In this activity, the researcher used paper folding to address students' misconceptions about the size of fractions. Many students believed that fractions with larger denominators are bigger, which is incorrect. By folding paper into equal parts and comparing them, the researcher showed that as the number of parts increases, each part becomes smaller. Students actively participated in folding and comparing the pieces. This visual and practical method helped them clearly understand the correct concept of fractions and overcome their misunderstanding.

Statistical Analysis:

Table -2: Details of samples test scores

Sl. No.	Samples	Pre-test Scores	Post-test Scores	T_1-T_2	%
01	Sample 1	10	22	12	48%
02	Sample 2	8	22	14	56%
03	Sample 3	8	23	15	60%
04	Sample 4	8	23	15	60%
05	Sample 5	7	24	17	68%

Graphical Representation:

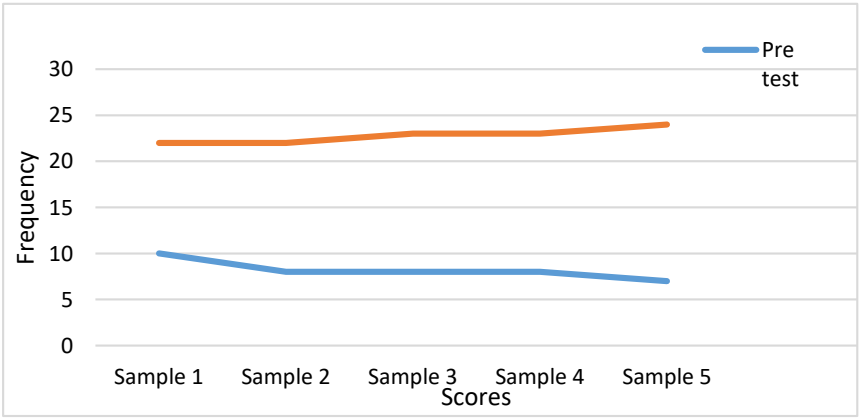

Figure -1: Line graph of Pre-Test and Post-Test

Interpretation of Result:

After comparing the pre-test and post-test scores of the five students, it was found that the students performed poorly in the pre-test, with scores of **10, 8, 8, 8 and 7**. After the teaching intervention, the same students took a post-test and their scores increased to **22, 22, 23, 23 and 24**. This improvement clearly indicates **positive progress in learning**.

The graphical representation shows a clear **upward trend** from the pre-test to the post-test, highlighting significant growth in the students' understanding of fractions. This means that the intervention and the teaching activities used in the action plan were **effective**. The students performed much better after the activities, demonstrating that the intervention helped them understand the concept of fractions and achieve higher marks.

Research Findings:

1. The chart explanation helped students identify the numerator and denominator correctly and improved their understanding of the parts of a fraction.
2. Using pizza and chocolates helped students easily relate fractions to real-life situations, making whole–part understanding clearer.
3. Students overcame their misconception that "bigger denominator means bigger fraction" after the paper-folding demonstration.
4. The ICT visuals enabled students to differentiate proper and improper fractions more accurately.
5. Hands-on involvement in all activities increased student participation and interest in learning fractions.
6. Visual and practical demonstrations (charts, food models, folding) made fraction concepts simpler and more meaningful for the students.
7. Activity based learning makes students to develop their confidence and accuracy in solving fractions problems.

Suggestions:

1. **Enhance Use of Visual and Concrete Materials**

   Students understood fractions better when they saw real-life examples. Hence, teachers should regularly use concrete objects (paper strips, fraction circles, sticks) and visual diagrams to strengthen conceptual clarity.

2. **Integrate ICT Tools More Frequently**

   ICT-based demonstrations (images, animations, videos, fraction simulators) improved student attention and understanding of proper and improper fractions. Teachers should integrate ICT in daily math teaching for better conceptual clarity.

3. **Provide Opportunities for Hands-On Activities**

   Activities involving group work, drawing, shading and comparing fractions helped students understand abstract concepts. More hands-on fraction activities should be included in classroom practice.

4. **Use Step-by-Step Instructional Strategies**

   Students learned effectively when the teacher explained fractions in simple steps (part–whole → representation → comparison → proper & improper). Teachers should continue using sequenced instruction for complex math concepts.

5. **Encourage Peer Interaction and Discussion**

   During activities, peer explanations helped weaker students understand better. Group tasks and peer-support strategies should be used more often.

6. **Include Real-Life Fraction Examples**

   Students easily related to everyday fraction examples (pizza, chocolate bars, fruits). Teachers should include more real-world contexts to make fractions meaningful and relatable.

7. **Conduct Regular Assessment and Reinforcement**

   Short assessments after each activity helped identify misunderstandings. Regular reinforcement through worksheets, quizzes and revision activities is recommended.

Conclusion:

The results of the post-test indicate that students showed a significant improvement in understanding the concept of fractions. The activities, explanations and simple examples used during the intervention helped clarify their doubts and strengthened their conceptual understanding. Students who were previously confused were now able to identify, compare and solve fraction-related problems accurately. Overall, the intervention proved to be effective in enhancing students' learning and improving their performance in fractions.

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