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Remedial Programme in Fractions for Primary School Students

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Abstract

An area in arithmetic that is, particularly, difficult for students is understanding the concept of fractions. They may feel embarrassed when problems related to fractions persist later in their lives. For teachers, it becomes difficult to remediate the misconceptions of the students in regular classrooms, particularly, when the concept is as challenging as the concept of fractions. The teachers must have at hand effective instructional procedures, material and other resources to teach mathematics to the students having conceptual problems in fractions based on the assumption that all can learn. The objective of this paper is to provide the teachers with best practices for teaching fractions to primary school students.

Introduction

In the twenty-first century, numeracy and literacy skills are basic for individuals to realise their potential. Mathematical knowledge and reasoning skills are no less important than reading ability. Math failure during the years of schooling, as well as, math illiteracy in adult life can seriously handicap both daily living and vocational prospects. So, the importance of learning mathematics in the beginning stages is tremendous. But for some children, it is noticed that this important skill is not mastered at an expected rate (the average rate at which most children learn).

Fractions are a consistent and recurring area of concern for teachers. Memorising rules and lack of knowledge of the basic concepts lead to difficulties in the application of fractions in day-to-day life. Research on fractions has shown that the students have difficulty recognising when two fractions are equal, putting fractions in order by size and understanding that the symbol for fraction represents

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a single number. The areas of skill deficits most consistently reported are related to fractions, decimals and percentage (McLeod and Armstrong, 1982). These deficits include both terminology related to fractions and operations with fractions.

Studies have also indicated that students face some difficulty in understanding the concept of fractions at every level of schooling. The main cause of this difficulty is the structure of fractions. In present day schools, representation of fractions is taught by rote memorisation method without taking into notice whether the child has conceptual knowledge of fractions or not (Aksu, 1997). The uniqueness on the visualisation of natural numbers cannot be seen in fractions. We can visualise natural numbers in terms of the value attached to these, e.g., eight means eight objects that we can count but in case of fractions we are not able to do so. These properties make it hard to understand the order and comparison of natural numbers (Zhou, 2005). Although no specific study has been found that throws light on the reasons for low performance in word problems and terminology related to fractions, deficit in language component is considered as the main reason for poor performance of students in questions involving words and sentences.

Naiser, Wright and Capraro (2004) found that teachers used several strategies to engage students, such as review of problems, real world applications, use of manipulatives and building on prior knowledge. The teachers used techniques, such as direct instruction technique, class discussion and cooperative learning. Researchers have developed some effective strategies for teaching the understanding of fractions, e.g., use of mnemonic devices for teaching addition and subtraction of fractions (Joseph and Hunter, 2001), manipulatives with pictures to solve word problems involving fractions (Bulter, Miller, Crehan, Babbitt and Pierce, 2003) and direct instruction model (Flores and Kaylor, 2007; Scarlato and Burr, 2002).

Although these strategies are effective in enhancing the students' mastery of fraction algorithms, they are not directly focused on their conceptual understanding. It is being reported that the area of student engagement was weak because a significant portion of student time was spent using pencil–paper technique and rote learning. Proponents of current efforts to reform mathematics education believe that if the quality of instruction is to be improved, many educators will have to dramatically change their perspectives on how mathematics should be taught. An attempt was made in this paper to develop remedial programme in fractions for students studying in Class III.

Deficit Areas in Fractions

Every teacher needs to know the nature, extent and causes of pupils' errors in a particular area of mathematics. It is only then that a teacher can diagnose and remediate

specific difficulties in a particular subject. The deficit areas in fractions are shown in Table 1.

When the bases of pupils' difficulties in fractions are understood, the stage of applying remedial measures comes. There was, however, no set pattern and no cut-and-dried formulae for remediation. Remedial programme is concerned with the pupils, who for some reason have formed ineffective methods of handling the concepts of mathematics. A remedial programme in fractions was developed by the researcher for the remediation of deficit areas in fractions.

The description of remedial programme in fractions is given as follows.

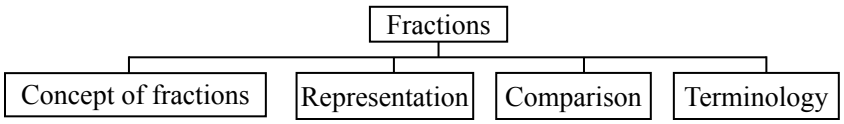

Table 1: Deficit areas in fractions

Area	Learning points	Deficits in fractions	Deficit areas
Fractions	(a) Concept of Fractions	Concepts of: (i) symmetry (ii) two halves (iii) three thirds (iv) four fourths	• Conceptual deficits
	(b) Representation	(i) Choosing the right fraction (ii) Matching the fractions (iii) Shading the given fractions (iv) Writing the fractions	• Visual discrimination • Figure ground perception
	(c) Comparison	(i) Comparing fractions when denominators are same (ii) Comparing the fractions when denominators are not same	• Perceptual motor integration • Procedural deficits
	(d) Terminology	(i) Numerator and denominator of fractions	• Language deficits

Learning Aspect: Concept of Fractions

Activity 1

Purpose

To provide conceptual understanding of fractions to the students

Procedure

- The students are divided into groups with four members each. Each group is given a chapatti. How will the groups divide the chapatti so that each member receives an equal portion?
- With this activity, it is shown how to divide a thing into equal parts.
- Next, each student is given a paper and is asked to fold it into half. The students divide a piece of paper into two equal parts. Hence, fraction is a part of the whole.
- The concept of fraction is further developed by the use of manipulatives, chocolate bars, measuring cups and fruits.

Activity 2

Purpose

To explain the meaning of the terms symmetry, halves, thirds, fourths, etc.

Procedure

- The students are asked to practise folding paper strips into equal parts.
- The paper is marked with a vertical line about 2 cm from the left margin.
- Then, the unfolded strip of paper (one whole) is pasted length-wise on the sheet by placing it against the line. This is the first street (one whole = first street).
- The students are shown how to fold a strip into two equal parts. The crease is darkened with a pencil.
- This strip is placed below the first strip, leaving a 2–cm gap between the strips.
- Next, the students are told to fold another strip of paper into half, and then, again into half. The folds are darkened and this strip is also placed 2 cm below the second strip. This process is continued up to eighths.
- The children are helped in folding another strip into thirds. This strip is prepared as before and is placed on the large sheet leaving 2 cm space below the fourth strip.
- Then, the next strip is folded into thirds, and then, into half to get sixths. The strip is prepared and positioned in the same manner as previously described. The process is continued for ninths and twelfths.
- Throughout the process, the students are asked to look for the patterns. How many folds does a strip have? This discussion is used to rearrange the strips so that the strip with two parts is followed by the strips having three parts, four parts, etc.
- Each strip of paper is treated as a street and all strips are of the same length.

- Each part of the street is a block and all blocks on one street are of the same length. Therefore, the first street has one block, second has two blocks, and so on.
- The children are asked to drive their cars on a street. It is discussed on which street they are located and how many blocks they have driven.
- They are led by the teacher to identify their location by street signs, in which the bottom number describes how many blocks a street has, and the top number tells the number of blocks on that street their car has been driven, e.g.,

$$\frac{1}{2} = \frac{\text{No. of blocks driven by car}}{\text{Total No. of blocks on the street}}$$

- The concept of equivalent fractions is also explained with the help of fractional chart, e.g., drive one block on the second street and drive two blocks on the fourth street.
- The students are provided with a fractional chart and a ruler. They are, then, directed to find a fraction equivalent to 3/5. They place the ruler vertically at $\frac{3}{5}$. Whatever fraction it covers, e.g., $\frac{6}{10}$ then $\frac{3}{5}$ is the equivalent fraction.

Learning Aspect: Representation of Fractions

Activity 3

Purpose

To enable the students to read and write fractions in longhand and numerical form

Procedure

- One student is asked to cut an apple into two equal parts and write with a marker 'one-half' on one part and $\frac{1}{2}$ on the other.
- Then, a pizza base is divided into three parts and each part is labelled as 'one–third' and $\frac{1}{3}$.
- Similar experiences are provided to the students by using chocolate bars and fractional charts.
- Flash cards are used as fractional game, in which the students had to match fractional numbers with their longhand forms.

Activity 4

Purpose

To give conceptual knowledge of numerator and denominator of fractions

Procedure

- The teacher has a box full of coloured balls. The students are provided with empty boxes.

- They are called out one-by-one and their boxes are filled with balls.
- The students are asked to count the total number of balls in their respective boxes and write that number on a sheet of paper.
- Then, they are asked to count the total number of red balls in their respective boxes and write in longhand and numerically the fraction of red balls.
- Now, the teacher explains the concept of numerator and denominator to the students. Numerator is the number of balls that are red and denominator is the total number of balls, e.g., three balls are red (numerator), and in total, there are 16 balls (denominator). Therefore, the fraction can be shown as $\frac{3}{16}$.

$$\frac{3}{16} \rightarrow \frac{\text{Numerator}}{\text{Denominator}} = \text{Fraction}$$

- The students remember the association better when it is explained that 'down' and 'denominator' both starts with 'D'.
- To represent fractions, it is explained to the students that the number above the bar is called the 'numerator' and the one below the bar is called the 'denominator'.

Learning Aspect: Comparison of Fractions

Activity 5

Purpose

To teach the students to compare fractions having the same denominator

Procedure

- Activity 2 is repeated and the students are asked to use two–three toy cars to drive in the streets. They are asked to drive till two blocks on the third street and drive another car till three blocks on the third street.
- They are encouraged to discuss how far the two cars are from the initial point of each street.
- Then, the fact is explored. Even though each car travelled on one street, the cars do not travel the same distance. Which car has covered more distance?

  e.g., Car A travelled = $\frac{1}{3}$

  Car B travelled = $\frac{2}{3}$

  So, $\frac{1}{3} > \frac{2}{3}$

- It is concluded that the fraction having the same denominator but greater numerator is greater.

- This concept is further developed with the help of rectangular pieces of a paper cut into strips of equal length.

Activity 6

Purpose

To enable the students to compare the fractions when denominators are not same

Procedure

- Again the students are asked to drive one car till two blocks on the third street and drive another car till two blocks on the fourth street.
- It is explored with discussion that each car travels two blocks but the cars do not travel the same distance.

e.g., Car A travelled = $\frac{2}{3}$

Car B travelled = $\frac{2}{4}$

So, $\frac{2}{3} > \frac{2}{4}$ (by visualisation)

- This concept is further developed with the help of cutout circles.

Conclusion

There are a number of researchers, who have concluded that given the specific instructional sequences and strategies, students having difficulties in mathematics and fractions can improve in learning the concept of fractions. Effective instructional strategies, such as concrete representation to abstract sequence, systematic explicit instruction, use of visuals and strategic feedback provide scaffolding needed by the students to link the concept of fractions with their daily lives.

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