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Research Paper | Education

Mutidimensional Techniques For Mathematical Operations

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ABSTRACT

Mathematics is an important subject in school curriculum. It is more closely related to our daily life as compared to other subjects. Today, mathematics holds an important place in schools. For giving, a place in curriculum there is no special need of evaluation and testing of it. Mathematics also helps to develop the child as social & intellectual citizens, like other subjects. It has its own disciplinary values. In addition to these, mathematics also develops those qualities which can be developed by other subjects. Napolean also remarked that, "The progress and improvement of Mathematics is linked to the prosperity of the state". The teacher must impress upon the students the educational values & necessity of the avoidance of errors in these operations and their careful execution. He/she must not allow any such errors to persist; otherwise the learner's later performances are bound to be defective.

KEYWORDS: Fractions, Adding, Subtracting, Curriculum, Operations.

INTRODUCTION

In the early stages, particularly, the children should learn about fractions from their own practical activities. We should make sure that children understand each idea in turn before they are introduced to the next. We should deal mainly, with the easy fractions which are in everyday use. The work should be carefully graded. "Understanding, should come before rules" are given (Kavitha & Saravanakumar, 2012). The rules may then be applied intelligently, thus reducing the risk of errors. The work and activities described are mainly concerned with helping children to understand what fractions are. It shows how fractions may be thought of in 'families', and how it is possible to change one kind of fraction for another. (suhrit k.Dey & Roma Dey, 2010). The children are also expected, at that stage, to learn how to find the simple fractional parts of money and various measure; & how to deal with easy calculations in addition, subtraction and multiplication.

In going on to further work with fractions, in the primary school, it is well to think again about the scope of the work (Layman, 2005). It is strongly suggested that there primary school is not the place for dealing with difficult & involved fraction; that we should deal mainly with the fractions commonly met in everyday life & business (Kulshestha 2003). If this work is understood & well practiced, then those primary school who go on to study, mathematics at the secondary level will have a good foundation on which to build.

A-FURTHER WORK IN ADDITION OF FRACTIONS

There are no new ideas to be learnt in "addition", but children may practice more difficult examples. For instance, they may add together more than two fractions, such as

(i) ½ + ⅔ + ¾ ; (ii) ¾ + 2/5 + 7/10

This is also the stage when the teachers may introduce the words numerators & denominator, and the phrase "lowest common denominator". The children are already familiar with the ideas. These ideas may now be connected with names, so that description & reference become easier.

B – FURTHER WORK IN SUBTRACTION OF FRACTIONS

The next stage in subtraction occurs when the mixed number from which we are subtraction contains a fraction smaller than that in the number we are taking away : for example 3 ¼ - 1 ¾. This stage in subtraction has been considered with whole numbers and in dealing with the calculation of measures. It is an idea with which the children are already familiar and it should be shown to them as such. The method of teaching should be the same as for the previous type of subtraction example.

But first it is wise to give the children some revision of this kind, referring to apparatus if necessary : 1 – ¼, 1 – ⅔, 1 – ⅝, 1 – 7/10, 1 – 5/12. In each case, they need to think of the whole one in terms of the fraction they are taking away. That is, they think of :

4/4 – ¼ = ¾

3/3 –⅔ = ⅓

8/8 – ⅝ = ⅜, etc.

The ability to do this is necessary when they come to examples such as that already given, namely 3 ¼ - 1 ¾.

It is suggested that, when first dealing, with an example of this kind, it should be set out in Oertical form like an ordinary, subtraction example. Children who have dealt with half pennies & farthings in British coinage can do this easily. But even in other countries the principle is familiar to the children, if they have followed the subtraction methods.

The standard phrasing, and the thought processes using the method of subtraction known as decomposition go like this : I cannot take three quarters from one quarter. So I use one of the three units & change it into quarters, making five quarters in all. Now I begin again.

```
2 5/4
3 ¼ -
1 ¾
-------
1 2/4
------
```

Three quarters from five quarters leaves two qualifications.

Put the two quarters in the fractions – column of the answer.

Now deal with the units.

One from two leaves one, etc.

The answer is 1 2/4, that is 1 ½

When the children have practiced this they go on to easy examples such as the one shown here, in which the ½ has to be changed for 2/4.

Similar examples should then be worked out in horizontal from like this :

(i) 2 ¼ - ¾ = 2 + ¼ - ¾ = 1 + 4/4 + ¼ - ¾ = 1 + 5/4 = ¾
= 1 2/4
= 1 ½

(ii) 3 ½ - ¾ = 3 + ½ - ¾ = 2 + 4/4 + 2/4 – ¾
= 2 + 6/4 – ¾
= 2 ¾

(iii) 4 ⅓ – 2 ⅔ = 2 + 1/3 – ⅓ = 1 + 3/3 + ⅓ – ⅔
= 1 4/3 – ⅔
= 1 ⅔

The teacher shows that the ideas are just the same as those used in the vertical arrangement . In example (iii), however, the units are subtracted before the functions.

In the next step there is again no new idea, but the children have to find common denominators before decomposition & subtraction can take place in this example :

5 ¼ - 2 ⅓ = 3 + ¼ - ⅓
= 3 + 3/12 – 4/12
= 2 + 12/12 + 3/12 – 4/12
= 2 + 15/12 - 4/12
= 2 11/12

C - FURTHER WORK IN MULTIPLICATION OF FRACTIONS :

(i) Multiplying a fraction by a fraction

We help children by returning, when the occasion demand to practical examples of arithmetical ideas. Most children are helped to understand the method and meaning of multiplying a fraction by a fraction if w again give them paper for folding, cutting, drawing & shading.

(a) The use of the word 'of' – 'The children' each have two equal rectangles of paper. They fold and cut one of these pieces into halves. The teacher then writes on the blackboard " ½ of ½", and says :

"I want you to find, by folding & cutting, a half of a half". The children do this, finding, by comparison with the whole, that a half of half is a quarter of the whole. This is put down on the blackboard :

½ of ½ = ¼

Similarly, by the use of folding and cutting, or by drawing & shading on squared – paper, the children find, for example, that :

½ of ⅓ = 1/6 ½ of ¼ = 1/8
⅓ of 2/5 = 2/15
½ of ⅔ = 2/6 or ⅓ ½ of ¾ = ⅜ ⅔ of 2/5 = 4/15

(b) The word 'of' replaced by the multiplication sign – we should next remind the children of one of the interpretations of the multiplication sign.

For example :

2 x 3 may mean two lots of three ;

7 x 2 may man seven lots of two ;

6 x 3 pence may mean six groups of three pennies.

Similarly, we can say that :

7 x ¼ means seven of the fraction ¼ ;

and ½ x ¼ means a half of a quarter;

and ⅔ x ¼ means two thirds of a quarter;

Thus we show that, in general, they can replace the word 'of' by the multiplication sign.

(i) ½ of ⅓ = ½ x ⅓ = 1/6
(ii) ½ of ¼ = ½ x ¼ = 1/8
(iii) ½ of ⅔ = ½ x ⅔ = 2/6 (= ⅓)
(iv) ½ of ¾ = ½ x ¾ = 3/8
(v) ⅓ of 2/5 = ⅓ x 2/5 = 2/15
(vi) ⅔ of 2/5 = ⅔ x 2/5 = 4/15

(c) Working out the answer

The examples already worked out, by using, rectangles and squared paper, are now set down again, using the multiplication sign as shown here. We now point out to children that the results suggest a way of getting the answers quickly. That is, by multiplying the two numerators together we get the numerator of the answer; & by multiplying the two denominator together we get the denomination of the answer.

For example :

(i) ½ x ½ = 1 x 1
———— = 1/4
2 x 2

(ii) ½ x ⅔ = 1 x 2
———— = 2/6 (= ⅓)
2x 3

(iii) ⅔ x 2/5 = 2x 2
———— = 4/15
3x 5

(iv) ¾ x 5/6 = 3 x 5
———— = 15/24 (= ⅝)
4 x 6

(d) Simplifying the answer

The children are already familiar with the idea of expressing fractions in a different form. They also know that, without change of value, a fraction may have its numerator & denominator multiplied (or dividend) by the same numbers. For instance, in dealing, with the 'answers' above, the children can see that 2/6 may be changed to ⅓ by dividing, the top & bottom by 2. Similarly, they can see that 15/24 becomes 5/8, if top & bottom are divided by 3.

(e) Simplifying before working out

Before going further, we must make an important principle clear to the children. (The understanding of the principle is also necessary for much of the work done later at the secondary school level).

The principle may best be explained by means of definite examples :

(i) Let us consider ' 6 x 5 ' divided by 2. The children can obtain the answer '15' by multiplying five by six and dividing the thirty so obtained by two. We can point out, however, that '6 x 5' may mean six groups of five. If these six groups are divided by two (that is, if we take a half of them) we have three groups of five, that is, 15.
(ii) An example such as '7 x 6' divided by 2 may be worked in a slightly, different way. Here we have to find a half of seven groups of six. Now, a half of one group of six is three, so that if we treat group of six in the same way, we have seven groups of three, that is, twenty-one.
(iii) A third example such as 6 x 4 divided by 2 can be worked in either of the two ways already described, so that the answer is obta from either 3 x 4 or 6 x 2.

From these and other similar examples the children see why only one of the two numbers (which are to be multiplied together) has to be divided & why they may choose the most convenient one. (Tyagi, 2008).

When this method is understood, it is possible to go on to show the children that, in the multiplication of fractions we can avoid long, calculation by simplifying the example before doing all the multiplication.

Let us look at example (iv) given under (c) that is :

$$\frac{3}{4} \times \frac{4}{6} = \frac{3 \times 5}{4 \times 6} = \frac{15}{24} = \frac{5}{8}$$

Bearing in mind the examples, such as 6 x 5 divided by 2, which they have just been doing, and knowing that they can divide the top and the bottom of a fraction by the same number, the children do not find it difficult to se that 3 x 5 --- 4 x 6 can be simplified before further multiplication takes place. They can divide both the '3x5' and the '4x6' by three; in the first case they divide the '3' of the '3x5' by three, in the second case they divide the '6' of the '4x'6' by three. So that the expression 3 x 5 ———— becomes 4 x 6

1 x 5
———— which, on multiplication, gives ⅝.
4 x 2

The example is first set down in full as :

Later, the children are shown that the written work is reduced by setting down the example as :

3 x 5
———— = 5/8
4 x 6

A later step shows how division of the up and bottom of the fraction may be done more than once. For example :

2 x 3 = 1 x 1

$$\frac{}{3 \times 4} \quad \frac{}{1 \times 2} = 1/2$$

We first divide both top and bottom by '2'. Then we divide both top and bottom by '3'.

2. Multiplying Mixed Numbers

When, multiplying, mixed numbers it is usually necessary to change them to improper fraction. We can then see whether simplification is possible before the multiplication proceeds.

For example :

$$2\tfrac{1}{4} \times 1\tfrac{1}{3} = \frac{9 \times 4}{4 \times 3} \quad \frac{3 \times 1}{1 \times 1} = 3$$

Teachers are often content to give their children a rule for the division of fractions, without explaining the reasons for it. Explaining the rule to children is admitted by difficult, but it is not impossible. Above all it is important that we, as teachers should understand the basic reasons for the use of the rule. The method of arrival at the rule may be quite clearly shown by carefully graded stages.

(a) Dividing fractions by a whole number

We show, for example, that to divide a number by two we may, find a half of it ;

$6 \div 2 = \tfrac{1}{2}$ of $6 = 3$

and $10 \div 2 = \tfrac{1}{2}$ of $10 = 5$

Similarly,

$8 \div 4 = \tfrac{1}{4}$ of $8 = 2$

and $12 \div 4 = \tfrac{1}{4}$ of $12 = 3$

In the same way,

$\tfrac{1}{4} \div 2 = \tfrac{1}{2}$ of $\tfrac{1}{2}$

$$\frac{1 \times 1}{2 \times 2} = 1/4$$

(The children already know that $\tfrac{1}{2} \times \tfrac{1}{2} = \tfrac{1}{4}$ from their work in multiplication).

Similarly, $2/3 \div 2 =$ --- of $\frac{1}{2}$ $\frac{}{2}$ $\frac{}{3}$

$$\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$$

$$\frac{1}{2} \div \frac{1}{2} = \frac{1}{3} \text{ of } \frac{1}{2}$$

$$\frac{1}{2} \div \frac{1}{2} = \frac{1}{4} \times \frac{2}{1} = \frac{2}{4}$$

$$\frac{1}{2} \div \frac{1}{2} = \frac{1}{4} \times \frac{2}{1} = \frac{2}{4}$$

We are thus dealing with the sharing, idea of division. For ex ample, ½ ÷ 2 means that we are breaking up the half into two equal parts, each part equal to one quarter of the whole.

(b) Dividing Whole numbers by easy fractions : (For example, ½, ⅓, ¼)

In explaining, this next step we use the grouping, idea of division.

An example such as $1 \div \tfrac{1}{4}$ may be put into these words : 'How many quarter in one whole?' = The answer is four. Similarly, $2 \div \tfrac{1}{4}$ (How many quarters in two?) – The answer is eight. And $10 \div \tfrac{1}{4}$ (How many quarters in ten?) – The answer is four, Similarly, $2 \div \tfrac{1}{3}$ (How many thirds in two?) – The answer is six and $5 \div \tfrac{1}{3}$ (How many thirds in five ?) – The answer is fifteen.

When the children have dealt with many examples like this they can be led to se that the answer may be quickly obtained by multiplying, the first number by the denominator of the fraction, for example,

$5 \div \tfrac{1}{3} = 5 \times 3 = 15.$

(c) Dividing a fraction by a fraction

(For example, ½, ⅓, ¼)

The same idea of division by grouping, is now extended to examples like this :

½ ÷ ¼ (How many quarters in a half?). We know the answer is two. But, using the previous idea, we multiply the half by four (the denominator of the fraction by which we are dividing), so that

$\tfrac{1}{2} \div \tfrac{1}{4} = \tfrac{1}{2} \times 4 = 2$

Similarly, $\tfrac{1}{2} \div \tfrac{1}{3} = \tfrac{1}{2} \times 3 = 1\tfrac{1}{2}$

& $\tfrac{1}{4} \div \tfrac{1}{3} = \tfrac{1}{4} \times 3 = \tfrac{3}{4}$

(d) Dividing by other fractions

(For example, ⅔, ¾, 5/8)

In order to complete the steps for understanding the rule for division of fractions, it is first necessary to show that the bigger the quantity, we are dividing by , the smaller will be the answer. (Riddle et. al (2000).

For instance $24 \div 3 = 8$, when we double the dividing answer we have, $24 \div 6 = 4$, & the answer is halved. If we, increase the dividing number four times, we have $24 \div 12 = 2$, and the answer is only a quarter of the first answer. Similarly, 36 3 = 12, and 36 ÷ 9 =

4. (Don plogr & Michal rooney, 2005) .

In the same way,

since $2 \div \tfrac{1}{4} = 2 \times 4 = 8$,

then $2 \div \frac{2}{4} = \frac{2 \times 4}{4 \times 2} = 4$

and $2 \div \tfrac{3}{4} = \frac{2 \times 4}{3 \times 3} = \frac{8}{3}$ (= 2 ---)

Similarly, since $\frac{1}{2} \div \frac{1}{4} = \frac{1 \times 4}{2 \times 2} = 2$

Then $\frac{1}{2} \div \frac{3}{4} = \frac{1}{2} \times \frac{4}{3} = \frac{4}{6}$

The children are then led to see that a general rule applies : to divide by a fraction we turn that fraction upside down & replace the division sign by a multiplication sign. The working then proceeds as in multiplication examples.

Conclusion :

Mathematics is a subject that has a lot of importance in shaping the career of students. If, therefore, we teachers are to find out which are the best ways of teaching fractions, (kavitha et.al 2012) we have to study, children much more closely, to watch how and what they learn, & how they 'pick up' information about numbers from all that is going on around them. We shall then be more likely to know when they are 'ready' for new learning & what to introduce at any, particular stage.

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