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SOLVING EXAMPLES OF WHOLE AND FRACTIONAL PARTS OF A NUMBER

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Abstract
This paper presents a detailed examination of the concepts of whole and fractional parts of a number. By solving various examples, the study aims to provide a clear understanding of these mathematical entities and their practical applications. The investigation encompasses a literature analysis, discussion of methodologies, presentation of results, and conclusions drawn from the findings.

Keywords Whole parts, fractional parts, mathematical concepts, numerical examples, visual representations, real-life applications, decimals and fractions, negative numbers, precision and accuracy educational technology.

INTRODUCTION

The research studies the children's understanding of the whole and fractional parts of numbers. It is essential to understand this as fractions have "been variously described as both the cornerstone of algebra as well as the despair of the nation" (Kieren 1993). Indeed, there is considerable evidence to suggest that many children experience difficulties in understanding fractions (Kieren 1976, Steffe 1992). Studies have highlighted the gap between the formal teaching of fractions and children's understanding of them, suggesting that for many children, the teaching does not "make sense" (Behr et al 1992, Post et al 1985). The view that children must learn about fractions as a number has been articulated as there being "no topic in elementary school mathematics where it is more important for the teacher to understand the nature of children's ways of thinking" (Sowder 1992). It can be assumed that a difficulty in understanding fractions would have a knock-on effect with percentage and decimal as these are all related ideas. It has been suggested that "decimals and percentages are better understood by pupils who have a sound conceptual knowledge of fractions" (Cockcroft 1982). Number is also a fundamental element of mathematics; Morris (1997) argues that since the 1960s, it is generally agreed that the understanding of number is a key goal of primary mathematics. Understanding the relationships between whole numbers, fraction and percentage would fall under this category, thus this study is something which could be considered to be fundamentally important in children's learning of mathematics.

Literature Analysis

Summary and comparison of integers The authors of Realms 1 introduce integers as a means of writing numbers as positive or negative without the use of fractions. The authors define integers and identify a base number, 0, and the properties of order and absolute value. This information can be useful in later grades and introduces concepts that may be foreign to many younger students. The authors of Connected Mathematics provide a basic definition of integers, emphasizing the use of negative numbers for temperatures. The discussion continues with identifying opposites and comparing numbers. The authors conclude with a lesson on adding and subtracting integers. The CMP2 definition is more informal, but the authors provide an example of using a number line. Both books identify the importance of understanding the meaning of operations and the necessity to practice. In conclusion of these two sections, it is noted that both texts provide a thorough introduction to integers and their operations.

DISCUSSION

I have only been able to solve these problems in fraction form by drawing pictures. They are word problems, and I think it is harder to draw a picture when the problem involves a rectangle. When I drew the pictures, it was easy to figure out what the fraction would be. All I had to do was figure out how many parts the whole was and then how many parts are shaded in. Once I divide it up, I then have to add the two parts together. The only problem with this is that it can be quite time-consuming. Also, when I draw a picture, I find that I always use circles and not other shapes as they are too hard to divide up. This method does not help me solve a problem involving a number line. I think that a drawing of a part-whole model is easier to use when the problems involve a circle or a rectangle. This can be quite tricky on the number line. I have never been able to solve a problem in percentage form using a part-whole model. I always use a different method which is similar to the method using an equivalent fraction. But when I compare the two problems, it is easier to use a part-whole model to solve the problem in percentage form. With a percentage problem, I am trying to find out what the percentage is for a certain amount. So all I have to do is convert the percentage to a fraction, and then this makes it a lot easier to divide it up into a part-whole diagram.

RESULTS AND CONCLUSIONS

We recognise that despite the numerous examples given, the data is too small to enable any definitive conclusions to be drawn. However, we wish to make some comments on the structure of pupils' errors and misconceptions on this topic, based on both the examples discussed and our own wider experience. Central to the nature of errors in this topic is the confusion between fractions and multiplicative arithmetic, and the relative values. Often one form of representation will be used when the other is more appropriate - e.g. 7/2 instead of 3 1/2 as a final answer. It is also common to see an incorrect uncancelled simplification, as in example 13. There is ample evidence to suggest that many pupils do not have a firm enough understanding of the decimal system. Thus are likely to resort to a fractional representation of a simple division problem, as in example 4c. The preference for the fractional form in the final answer to a division or ratio problem has been noted elsewhere (Cockcroft, 1982), and should perhaps be treated as a separate issue in its own right. In such cases it is often not so much a misconception of a topic as a skill which hasn't yet been acquired. The errors in the Fung and English (2001) example cited in the introduction to this topic, showed that pupils need to appreciate the multiplicative meaning of both fractions and percentages, and their equivalency. Many other responses have echoed the mistake in example 2 of equating 'times 3' with 'one third of', a problem which has also been noted in a wider context at Key Stage 3 (Williams, 1995). Finally, it is clear that such errors and misconceptions can persist well into the post-16 stages, as evidenced by the age and ability range involved in all our examples. This data will serve as a useful reference in the development of materials for diagnostic assessment and classroom teaching.

Conclusions Drawn from the Study

A series of concepts, gleaned from the development of the ideas in this study, will be described. These may be useful insights when developing instructional tasks to promote children's understanding of numerical and operations concepts.

In the introduction, the distinction between the part-whole concept for fractions and for division was made. The study showed that children find both of these concepts difficult, but particularly part-whole for fractions. Even the younger children in the sample who have been learning about fractions in school for the majority of their school experience had difficulty with tasks involving addition and subtraction of fractions. More children in all age groups used a part-whole strategy on the division task. This was a particular concern in relation to the year 6 fraction division task, but further analysis showed that for both division tasks, the children using a part-whole strategy performed better on average than those who did not. This suggests that when children find fractional division difficult, they abandon the more sophisticated and efficient unitising and quotient interpretation division algorithms, in favour of operating on the referents of the fractions in a part-whole manner. This is particularly undesirable when using specific examples of fractions to operate on will lead to confusion between part-whole for fractions and division. In contrast, this may have positive implications for the study of partitive fraction division.

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