INTRODUCTION TO THE CONCEPT OF MULTIPLICATION IN FRACTIONS

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Abstract

Experience has shown that the concept "Fraction" is abstract and difficult to conceive, especially among pupils/students who speak English as a second language. Fractions and any part of a whole are perceived as equal. As a result, further arithmetic operations on fraction are considered difficult. For instance, the result of multiplying two or more whole numbers produces a bigger number than any of the initial numbers used in the multiplication. This is in contrast with the results obtained when two or more fractions are multiplied and the result becomes smaller than any of the initial fractions. This paper attempts to use practical activities to justify the multiplication of fraction concept and explains a significant difference between fraction and an ordinary part of a whole.

Introduction

The knowledge I am only able to narrate could easily be forgotten and lost to history, the knowledge I only am able to carry out without having a firm control of the theory behind it could not assist me to be innovative but any knowledge that results from practical experience will enable me to innovate, invent and improve upon it. No matter how difficult and complex a concept could appear initially, if a child has been allowed to form a personal opinion of the concept and be facilitated to try out his/her understanding practically, then such a child will remember and improve on the concept. There are numerous challenges confronting youths all over the world in taking a career in sciences and science education. Lack of financial rewards for scientists and science educators, lack of political will on the part of the society and negative attitude of the learners are some of the challenges. This paper focuses on one of the factors responsible for the learners' negative attitude in taking career in science and science education – Lack of proper and clear understanding of the concept behind any scientific theory. The author believes that these challenges could be resolved if learners are made to understand the concepts practically and know where the concept can be applied. Despite the importance of fraction in our daily life, it is one of the many topics learners found as a challenge in primary and secondary schools (SMASE – Nigeria Baseline Survey, 2006).

In this paper, activities that are carried out to explain the concept of multiplication in fraction will be described. The paper considers challenges in multiplying fractions of the same and of different denominators.

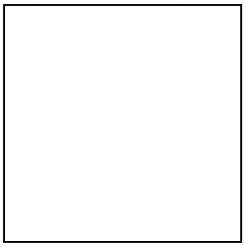
Methodology

The practical method adopted is the use of paper folding and shading out the areas of interest. The method the author considers applicable to learners in primary and junior secondary schools. The author has successfully tried the method in primary schools in Nigeria and in training teacher-trainers in Nigeria. The materials to be used are simple, affordable and easily available in any school environment. The clear concept of fraction being different from ordinary part of a whole must be given to the learners before practical activity on multiplication - "A part of a whole can form a fraction of the whole if the whole is subdivided equally in to such parts". The previous knowledge of the learner could include: -

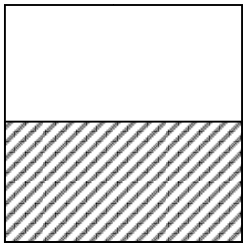
- Ability to fold papers
- Ability to count
- Knowledge of plane shapes (Square, Rectangle, \etc)

Multiplication of Fractions with the Same Denominators

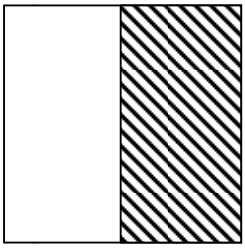
As shown in Figure 1, a sheet of duplicating paper is folded into two equal parts along the length of the paper, and then the fraction of one of the parts in relation to the equal parts of the whole is $\frac{1}{2}$, this is the result of one action. Then fold the same paper into two equal parts along the width of the paper, then again the fraction of one of the parts in relation the equal parts of the whole is $\frac{1}{2}$, this is the result of the second action. After the second folding, how many equal parts can one get out of the whole? There are now four equal parts. Then if one of these equal parts is taken, what fraction will it be of the total equal parts? The fraction will be $\frac{1}{4}$, that is, $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ (Note that the word "Multiplication means the number of times an event takes place, therefore $\frac{1}{2}$ **x** $\frac{1}{2}$ is requesting to know the numbers of times a whole is being divided in into two equal places. Therefore $\frac{1}{2}$ **x** $\frac{1}{2}$ gives the result of dividing a whole into two equal parts twice and from the diagram below, if one divides a whole paper into two equal parts twice it results into four equal parts and only one out of the four equal parts is shaded twice ($\frac{1}{4}$), hence one can conclude that $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$



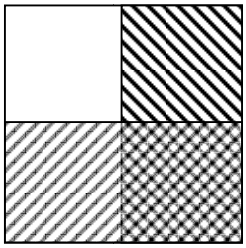
A whole paper
Stage 1



First division of the whole paper into two equal parts along the length
Stage 2



Second division of the whole paper into two equal parts along the width
Stage 3



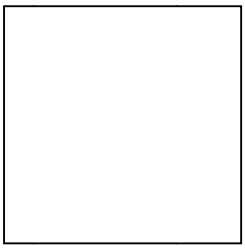
After the second division, the whole paper now contains four equal parts and only one of these parts belong to the first and the second divisions
Stage 4

Figure 1. Multiplication of Fractions with Same Denominators

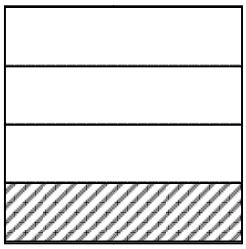
Therefore, we can conclude that $\frac{1}{2}$ x $\frac{1}{2}$ = $\frac{1}{4}$.

Example of Multiplication of Fractions with Same Denominators

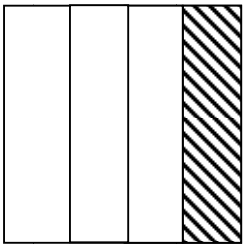
Similarly, as shown in Figure 2, $\frac{1}{4}$ x $\frac{1}{4}$ can be shown by folding a whole paper into four equal parts two times.



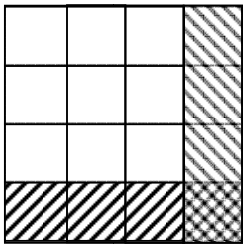
A whole paper
Stage 1



First division of the whole paper into four equal parts along the length
Stage 2



Second division of the whole paper into four equal parts along the width
Stage 3



After the second division, the whole paper now contains sixteen equal parts and only one of these parts belong to the first and the second divisions
Stage 4

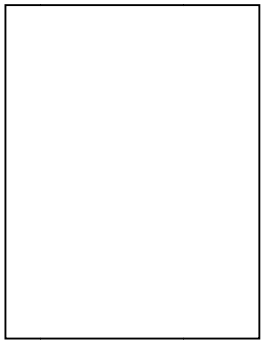
Figure 2. Example of Multiplication of Fractions with Same Denominators

Therefore, we can conclude that $\frac{1}{4} \text{ x } \frac{1}{4} = \frac{1}{16}$

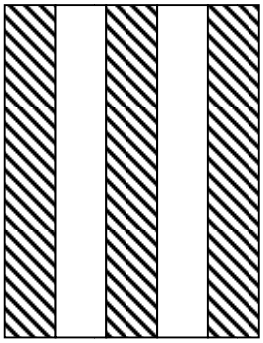
Multiplication of Fractions with Different Denominators

Figure 3 shows the procedure for multiplying fractions with different denominators, that is,

$\frac{3}{5} \times \frac{4}{7}$



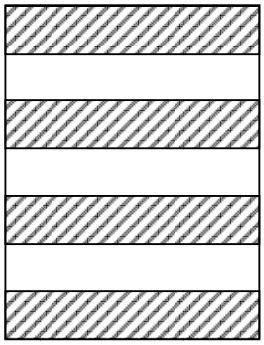
A whole paper
Stage 1



Firstly, divide the whole into five equal parts along the horizontal side and select three out of the five equal parts to obtain

$\frac{3}{5}$

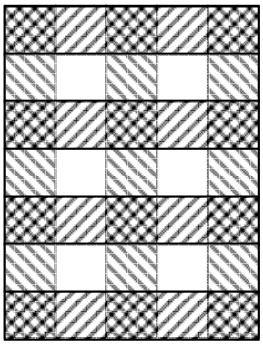
Stage 2



Secondly, divide the same whole into seven equal parts along the vertical side and select four out of the seven equal parts to obtain

$\frac{4}{7}$

Stage 3



Thirdly, count the total number of equal parts on the paper and select the total number of the equal parts that are shaded twice to obtain

$\frac{12}{35}$

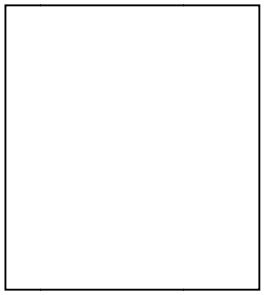
Stage 4

Figure 3. Multiplication of Fractions with Different Denominators

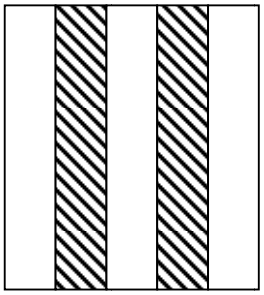
Therefore, we can conclude that $\frac{3}{5} \times \frac{4}{7} = \frac{12}{35}$

Example of Multiplication of Fractions with Different Denominators

Similarly, as shown in Figure 4, $\frac{2}{5}$ x $\frac{2}{3}$ can be shown by folding a piece of paper into five equal parts and then shading two of its parts. This is followed by folding the piece of paper on the other side into three equal parts and then shading two of its parts.



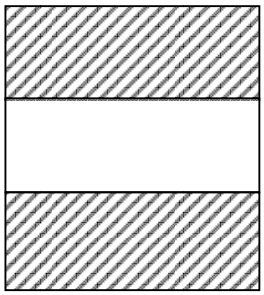
A whole paper
Stage 1



Firstly, divide the whole into five equal parts along the horizontal side and select two out of the five equal parts to obtain

$\frac{2}{5}$

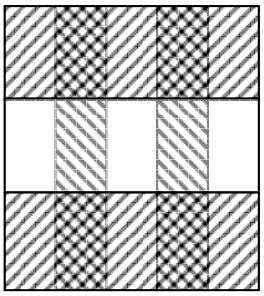
Stage 2



Secondly, divide the same whole into three equal parts along the vertical side and select two out of the three equal parts to obtain

$\frac{2}{3}$

Stage 3



Thirdly, count the total number of equal parts on the paper and select the total number of the equal parts that are shaded twice to obtain

$\frac{4}{15}$

Stage 4

Figure 4. Example of Multiplication of Fractions with Different Denominators

Therefore, we can conclude that $\frac{2}{5}$ x $\frac{2}{3}$ = $\frac{4}{15}$

Conclusion

In conclusion, the author is convinced that pupils/students would have formed a proper concept of multiplication of fraction after performing the above activities severally with different fractions. These activities will assist pupils/students to demystify the abstract nature of fraction and explain why multiplication in fraction results into a fraction smaller than any of the initial fractions. The author also predicts that after several activities, pupils/students will come to realize that by multiplying the numerators and place the result over the product of the denominators produce the same answer as obtained from the activities. From the activities, it can be deduced that "In any given fraction, the number below (Denominator) gives the total numbers in which the "whole" has been equally divided, while the number above (Numerator) gives the number selected out of the equal parts."

Reference

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