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IMPROVING MATHEMATICS EDUCATION AMONG TEACHER-TRAINEES THROUGH THE USE OF CUISENAIRE ROD IN THE TEACHING OF FRACTION

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ABSTRACT: *The study is about using Cuisenaire rods to improve the teaching of fractions to teacher trainees (UTDBE) in St. Joseph's College of Education - Bechem in the Tano South District in the Brong Ahafo Region. The sample comprised thirty-six (36) teacher trainees in St. Joseph's College of Education. It involved the use of pre-test, post-test and questionnaire as the methods for data collection. The questionnaire was also analyzed. The findings revealed that the use of teaching and learning materials (Cuisenaire rods) greatly improve the teaching of fractions in mathematics. It was also realized that before teacher trainees could grasp the concept of addition and subtraction of fractions, the concept of equivalent fractions should be well understood. It was also realized that teacher trainees grasp a concept when they are taken through the procedure from concrete through semi-concrete and finally to the abstract. The implication of the findings is that teacher trainees should be encouraged to use teaching and learning materials to teach when introducing a concept. The concept of Equivalent fractions should be taught first before addition and subtraction of fractions are taught.*

KEYWORDS: Mathematics, Cuisenaire Rods, Teacher Trainees, Fraction, Multiplication

INTRODUCTION

Mathematics is one of the important subjects within the list of foundation subjects that constitute the core curriculum for basic (i.e. compulsory primary and secondary) education in most countries throughout the world. The subject occupies a privileged position in the school curriculum because the ability to cope with more of it improves one's chances of social advancement. It attained this position since it was made to replace classical language like Latin or Greek which prior to the early half of the twentieth century were used as screening devices for entry to higher education and certain professions. (Howson and Wilson, 1986) as cited in Mereku (2000). The importance of mathematics can be seen from its application in our daily lives and its role in Technology. No other subject forms a strong binding force among various branches of science than mathematics and without it; knowledge of science often remains superficial (Singletary, 1997). This indicates that without a proper grasp of the underlying principles in mathematics, the necessary skills and concepts in Science and Technology cannot be acquired and applied by students. Ghana as a nation cannot develop fast if sustainable strategies are not put in place to improve upon the teaching and learning of mathematics in our schools. This is because these pupils or students are the future leaders of the nation. If the educational structure cannot give them a good foundation in mathematics, then they cannot have the requisite materials and the Technical know-how needed to contribute their quota towards the development of Ghana.

McBride and Silverman (1997: l02) said "mathematics can enable students to achieve deeper understanding of science concepts by providing ways to quantify and explain science relationships". Even though mathematics is one of the important subjects, most students shy away from it. Some students wish they could be excluded from mathematics lessons. Even though they know it is a useful subject, they find it difficult. That is why they develop a negative attitude towards it. Mathematics is widely recognized as a problem in many circles. Most candidates fail to get admission into tertiary institutions because of failures in mathematics. Every child who enters the educational system had to study mathematics till the matriculation level (Evans 2002).

St Joseph's College of Education, Bechem is an institution in the Tano South District in the Brong Ahafo Region of Ghana. According to Institute of Education, University of Cape Coast (2007) Chief Examiner's Report of UTDBE (Untrained Teachers Diploma in Basic Education) indicates that many students disliked questions that involve fractions. UTDBE students had difficulties with addition of fractions with different denominators. They could not make use of equivalent fractions. Besides, questions that involve division and multiplication of fractions were not well answered. Students could not state the vital steps needed before writing the final answer. They therefore developed phobia towards questions involving fractions. The fraction concept in its broader sense starts from the day the child enters the world. The child experience with fractions is through everyday life. For instance, the components of breast milk that the child starts to suck are expressed in fractional forms. As specified by the Ghana Health Service advocacy for exclusive breast feeding for the first six months of the child's live the breast milk consists of seventy-five percent (75%) water and twenty-five percent (25%) milk. Burton and Ted (2000) reported that the common form of fraction has the advantage of being intuitively understandable when we want to talk about parts of a whole. Working with fractions poses serious problems to most candidates especially UTDBE candidates had difficulties in solving questions that involve fractions. Important steps of working are often left out by candidates (Institute of Education, University of Cape Coast (2007) Chief Examiner's Report of UTDBE). A distinguished American Professor of Mathematics, Whiney said "for several decades we have seen increasing failure in Mathematics in spite of intensive efforts in many directions to improve matters. It would be reasonable also to suspect that the causes are fundamental in the ways in which they are taught, how children learn and the teaching situations" (Skemp, 1991:72). The most effective means of learning a concept or skill is through active participation.

Statement of the Problem

One of the weaknesses the 2002, 2004 and 2008 Basic Education Certificate Examination (BECE) listed in the Chief Examiner's Report include candidates' inability to answer questions that involve fractions. According to the chief examiners report Institute of Education UCC (2007) observed that most of the UTDBE students were not able to answer questions that involve addition, subtraction, multiplication and division of fractions. The researcher is not surprised that some candidates at the BECE could not effectively answer questions that involve fractions simply because most of these teacher trainees do not understand the concept of fraction well therefore are unable to effectively teach the concept of fractions well. The study therefore seeks to address the difficulties teachers' trainees face in teaching fractions.

Purpose of the Study

The study is to find out;

- Whether the use of teaching and learning materials that is Cuisenaire rods would improve the teaching of fraction.
- Whether the concept of equivalent fractions could be used in solving addition and subtraction of fraction.
- The difficulties teacher trainees encountered when adding and subtracting fractions.
- Teacher trainees' ability to divide whole numbers by fractions
- Whether teacher trainees would be able to multiply two unlike fractions using
    - Concrete material(s).

Research Questions

The following research questions will guide the conduct of the study;

- To what extent would the use of teaching and learning materials improve the teaching of fractions?
- To what extent would the concept of Equivalent fractions be used in solving addition and subtraction of fraction?
- What are the difficulties teacher trainees encountered in addition and subtraction of fractions?
- To what extent would the teacher trainee be able to divide whole numbers by fractions?
- What are the difficulties teacher trainees encountered in using a named concrete material (Cuisenaire rods) in multiplication of unlike fractions?

Significance of the Study

The study serves as a guide for teachers to vary their methodology to enable students to understand the concept of fractions. It also serves as a resource material for all stakeholders and others who would like to research further into this area of national interest.

LITERATURE REVIEW

The word fraction is taken from the Latin word "frangere" which means to break. This suggests that fraction may be described as a part of a whole where the whole could be a unit or a set of objects. Paling (1996) states that children in primary and secondary schools spend many hours each year work involving fractions. They learn how to add and subtract two fractions, to multiply one fraction by another and to divide one fraction by another. They are then introduced to quick methods and to phrases such as "turn upside down and multiply".

Yet, at the end of all their computations with fractions, students on teaching practice are often asked to repeat work that the children had done before, but did not appear to understand. Paling (1996) reveals that children who go to secondary schools or other forms of further education there is the need to be able to use operations (addition, subtraction, multiplication and division) with common fractions. This is particularly true in mathematics and science, especially when letters are used to represent numbers for example, in solving equations and in changing formulae, algebraic fractions often occur and an understanding of the methods used for the operations (addition, subtraction, multiplication and division) are essential. Dolan, (2000) observes that apart from whole - number computation, no topic in the elementary mathematics curriculum demands more time than the study of fractions. Yet, despite the years of study, many students enter high school with a poor concept of fractions and an even poorer understanding of operations with fractions. When asked about their memories of fractions, adults will often reply, "Yours is not to reason why, just invert and multiply." Dolan, (2000) further states that the fraction can be viewed as the solution to the problem of dividing 3 dollars among 4 people: 3 4. For students to understand this connection between whole number and fractions, teaching about fractions and their operations must be grounded in concrete models. A firm foundation for number sense involving fractions, and a deeper understanding of the algorithms for operations with fractions must be developed and preceded formal work with fractions.

Brunner as cited in Martin et al (1994) observes that when a child or an adult is learning a new concept, one must go through three stages. These stages are used simultaneously for acquisition of new skills throughout man's life time. They also revealed that it was the duty of the teacher to use concrete materials to introduce the topic first and gradually proceed to picture and diagrams, that is from concrete to semi-concrete and finally to the abstract stage. Hemstock and Costelpe (1975) explain the concept "fraction". The two authors explain vulgar fractions as the same as simple fraction for example they explained that the lower number that is the 4 is the denominator and 1 is the numerator. The golden rule sets that before fraction could added to get, however and cannot be added until they changed into fractions of the same denominators. They also explained that if a fraction is multiplied by a whole number, the denominator remains the same. For instance, 3. Moreover when a fraction is multiplied by a fraction, multiply the numerators together and the denominators also together, for example

The rule also says that divisions of fractional numbers averts the divisor and multiply the numerators and the denominators for instance

$$\frac{8}{15} \div \frac{2}{5} = \frac{8}{15} \times \frac{5}{2} = \frac{40}{30} = \frac{4}{3}$$

Obeng (2005) stated that addition or subtraction with different denominators can be solved by using the following steps. Express each fraction as an equivalent fraction with same denominators of the fraction as illustrated in the examples below: $\frac{4}{7} + \frac{3}{5}$

Equivalent fraction of $\frac{4}{7}$ are $\frac{8}{14} = \frac{12}{21} = \frac{16}{28} = \frac{20}{35} = \frac{24}{42}$

And those of $\frac{3}{5}$ are $\frac{6}{10} = \frac{9}{15} = \frac{12}{20} = \frac{15}{25} = \frac{18}{30} = \frac{21}{35}$

$$\frac{4}{7} + \frac{3}{5} = \frac{20}{35} + \frac{21}{35} = \frac{41}{35}$$

In the same way; $\frac{2}{3} - \frac{1}{4}$

Equivalent fractions of $\frac{2}{3}$ are $\frac{4}{6} = \frac{6}{9} = \frac{8}{12} = \frac{10}{15}$

And those of $\frac{1}{4}$ are $\frac{2}{8} = \frac{3}{12} = \frac{4}{16}$

a). $\frac{2}{3} - \frac{1}{4} = \frac{8}{12} - \frac{3}{12} = \frac{5}{12}$

Elizabeth (1988) maintains that "diagrams can be used to make some classifications which young children have done, which facilitates knowledge building. Elizabeth (1988) further described the usefulness of diagrams as teaching and learning materials when one has to solve mathematics problem. From the above assertion it is evident that diagrams enable the problem - solver to obtain an insight of the problem at hand, enhance formulation of various strategies that will help one solve the problem and aid one to construct proofs of several theorems. Dirkes (1980) emphasizes that when children use drawings to evaluate their attempts to show an idea of fractions, they soon use space to help them produce answer to computational examples through a problem - solving process. Dirkes goes further to state that pictures and concrete objects, for that matter models serve to communicate mathematics in a way that words and symbols cannot do. This implies that concepts are well understood only when they are illustrated through objects diagrams or pictures.

According to Stanley and Peck (1981), it is good to start fraction by sharing. That is given each child an empty egg carton and have them place the egg cartons bottom side upon their desks in front of them. Ask them to place a piece of yarn across the carton to show where they cut it, if they were to share a carton with two people (including themselves as one of the two), three people, four people and so on. The "3" is written as an instruction to perform the sharing act and is read "share with 3", "4" share with four and so on, becomes an instruction. Similarly, other fractions are conceived in terms of instructions for sharing and covering. For example, $\frac{2}{3}$ is read "Share with three, cover up two shares". This simple approach to fractions removes many of the difficulties children frequently have with fractions. Working with physical materials that can be seen and felt seems to be helpful. Children like to do the

physical sharing and manipulating of the objects. A wide variety of materials to share increases understanding and skillful questioning sustains interest.

Inadequate Use of Teaching Learning Materials

In Ghana, most schools learn without adequate teaching learning materials. Dotse (2000) states that 'instructional aids and games when properly employed make learning simultaneous, effortless and quite enjoyable. Rather unfortunately, the use of these materials is on the decline'. Cuisenaire rods can be used to teach fractions.

Language Mistakes

The language used by the teacher is important if he or she is to make positive impact on his or her learners. William, (1986: page 21) states that "more importantly mathematical languages should be carefully and accurately used from the beginning". They further observed that "mathematical vocabulary needs to be taught and should be taught in the context of practical experience" for instance, the fraction should be described in words as two-seventh, with emphasis on the two. A phrase such as two over seven should be avoided. Watson (1980) gives a concise description of the errors many pupils make in the operations on fractions. The author includes the common mistakes such as the following

$$2\frac{1}{2} \times 1\frac{2}{5} = \frac{5}{2} \times \frac{7}{2} = \frac{35}{2}$$

Watson explains that this is the result of the applications of the rule for addition of fractions with the same denominator.

According to Apronti (1987) identified fraction as a challenging topic for both teachers and pupils. The author outlined the following strategies for teaching the concept fraction.

- Let pupils see fraction as part of a whole object or a group of objects.
- Note that the concept of fraction is based on equal division.
- Build up the concept of fraction gradually with the concept of one- fourth, one third and so on
- Use paper folding and sharing, then chart or fractional board to compare fractions and find equivalent fractions.

According to Amissah (1998) in a paper delivered at the 26th National General Workshop of the mathematical Association of Ghana (MAG), August, 24 - 29, 1998, at St. James Seminary School, Sunyani, the analyses presented revealed that mathematics performance at the primary level gives much cause for concern. Primary Education Program (PREP) conducted a study on selected teacher trainees using the same set of "Criterion - Referenced Test" (CRT) test items. The study revealed that some of the teacher trainees faulted in the very areas that the pupils had performed poorly. Amissah further stated that he was privileged to serve on a panel for selecting the National Best Teacher's award winners. The candidates who appeared before the Panel were those adjudged the best Regional award winners. One of the questions a panelist asked at the primary level was 'how do you teach

$\frac{1}{3}+\frac{1}{5}$ "to primary four?" Two of the ten award winners gave this method "Add the numerators and the denominators".

Hence $\frac{1}{3}+\frac{1}{5}=\frac{2}{8}$

Problems Encountered by Pupils

Pupils find it difficult to deal with fractions. The reason might be that they do not grasp the concept well. The understanding depends upon the ability of pupils to relate symbols with words. Multiplying fractions by a whole number was a problem, but adding fraction is a deeper crisis. For instance, $2x\frac{1}{3}$was given as $\frac{2}{6}$(treated as a vector). Below are samples of pupils' work presented to the researcher.

- $-7\frac{3}{4}+12\frac{2}{5}=-31+62=31$, The pupils' explanation was that we multiplied 4x7 and added 3 and also multiplied 5 by 12 and added 2 to obtain -31 and 62 respectively which were summed up to 31
- $\frac{2}{3}+\frac{4}{5}=\frac{6}{8}$, The pupil explained that she added the numerators and denominators to obtain $\frac{6}{8}$ that is (2 + 4) and (3 + 5). In analyzing the computation errors made in the fraction 8 exercise, it is evident that mush of the difficulty lies in a lack of conceptual understanding as emphasize by Carpenter (2001:36). It can be concluded that children should be exposed to variety of experiences with grouping before being introduced to fractions.

Problems Encountered by Teacher Trainees

Teacher trainees find it difficult to teach fractions effectively. Some teacher trainees also use oranges to introduce fractions to their pupils which is not the appropriate teaching learning materials for that concepts. Below are samples of teacher trainees' work when the researcher conducted quiz to find out their level of understanding the concept fraction.

- $\frac{3}{4}-\frac{1}{4}=\frac{2}{0}$=2.Most of the teacher trainees subtracted the numerators that are 3 - 1 and the denominators that are 4 - 4 and their difference were 2 and 0 respectively. They finally subtracted 0 from 2 which resulted 2 .
- $\frac{2}{5}+\frac{1}{6}=\frac{3}{11}=3+11=14$ Most of the teacher trainees added the numerators and denominators and again added the results of both the numerators and denominators to get their final answer 14.
- $\frac{2}{9}\div\frac{2}{3}=\frac{1}{3}$ Most of the teacher trainees divided both the numerators and the denominators and further divide them that is 2 ÷ 2 = 1 and 9 ÷ 3 = 3. They finally got$\frac{1}{3}$. For multiplication they multiply both the numerators and denominators to get their results. It can be concluded that teacher trainees have not grasp the concept of fraction and are unable to impact the knowledge to their pupils.

Methods for Learning Mathematics

Piaget, Bruner and Dienes each suggests that learning proceeds from the concrete to the abstract. It is believed that children should be actively informed in the learning process and opportunities for talking about their ideas should be provided. It is also believed that symbols and formal representation of mathematical ideas follow naturally from the concrete level, but only after conceptualization and understanding hence taken place (Rober: 1998)

Operation with Fractions

The key to a meaningful presentation of the operations with fractions is to establish a firm background in fractions, especially equivalent fractions and modeling fractions. Then, problem situations that involve fractions and operations should be presented. Children also gain a better understanding of operations with fractions if they can estimate answers by using whole numbers and fractions such as one-half or one-tenth. For example, before actually computing the answer to three whole numbers two on three plus four whole number five on six, they should realize that the answer is more than 7. Infact, since $\frac{2}{3}$ and $\frac{5}{6}$ are each more than $\frac{1}{2}$the answer is more than 8. Developing these types of number and operation sense willmake it easier to establish what reasonable answers to problems are.

Applications of Fractions

- The concept of equivalent fractions is needed to mix two or more ingredients in the kitchen when cooking.
- The concept of fractions is needed to take the right number of drugs when one is sick. The student may have to take half sachet of medicine mixed with half a glass of water two times daily.
- Students can best plan their menu and have balanced diet over a stipulated period of time with the idea of fractions. This is because some amount of Carbohydrates may be taken with some amount of protein.
- Until recently, the mineral components in milk were considered to be a little value. Their use in various applications was considered excessive and could adversely affect the taste and texture of the finished product. For these reasons, the mixing of milk components with other ingredients to produce industrial blends is a way of better responding to the particular requirements of end users. This offers different components of high-performing milk and fruit beverages and the idea of rations is the reason for the different components of milk in the market.

Methodology

This aspect highlights the procedure used in obtaining the data for the research work. It described the population and sampling techniques as well as the type of instrument used in the collection of data and data analysis. The study seeks to the use of quantitative analysis and the Research questions

Research Design

Montgomery (1991) refers to a reach design as a plan for selecting subjects, sites and data collection procedure to answer proposed research questions. Robson (2002) as cited in Avoke (2005) describe a case study as involving an empirical investigating a particular contemporary phenomenon within its real context using multiple sources of evident. This study was meant to address the difficulties teacher trainees face in teaching fraction. Class exercise were given to the teacher. It was found to that they had difficulties with problem involving fractions.

The Pre – Test was used to diagnose the problem that teacher trainees had in adding, subtracting, multiplying and dividing fractions. Based on the performance of the teacher trainees in the pre – test, an intervention strategy was implemented on 13th August, 2008. The intervention continued to 14th September, 2008. Class exercise were given to them as the researcher put strategies in place to help them. A Post – Test was then conducted at the end of the intervention period to find out the effectiveness of the intervention. 20 minutes was allotted for this exercise. The post – test was conducted on the 15th September, 2008.

Source of Data

The researcher focuses on UTFBE students' conceptual understating of fractions. The research was done at St. Joseph's college of Education – Bechem.

Population

A population is a group of element or variables. Be it human, objects or events that can form to specific criteria and which are interested to a researcher for interning to generalization of result. The population of the research consists of UTDBE students in St. Josephs' College of Education – Bechem. It was selected because of proximity of the area of study of the researcher. The choice of this was based purely on convenience.

Sample Size and Sampling Procedure

The researcher selected 36 teacher trainees comprising 18 men and 18women. All the men were grouped and the researcher wrote 18 "yes" and the rest "No" on a sheet of paper and folded them. So those who picked "yes" were selected. The women went through similar procedure and the 18 were also selected.

Intervention Design

The structured table below served as a guide for the intervention strategy.

The study used activities and demonstration methods to help the teacher trainees to overcome the difficulties they face in teaching fractions.

The demonstration helped the teacher trainees to develop the concept of fraction when an idea is explained; the researcher had to demonstrate it for clarity on the part of the learners. Activities were used and this made trainees to participate meaningfully in the lessons.

Below was how both the major and minor interventions were implemented.

- Demonstration: Real objects and Cuisenaire rods were used to demonstrate the concept of fraction.
- Equivalent fractions.
- Teaching addition and subtraction of like fractions.
- Teaching addition and subtraction of unlike fraction and fractions.
- Teaching multiplication of common fraction and mixed fractions.
- Teaching division of common fractions and mixed.

Demonstration (Breaking and Cutting)

The researcher introduced the concept of fraction by folding a sheet of paper equally among two students. The researcher further discussed with students that one part is called one – half because a whole has been divided into two equal halves that is why one part is considered as one half. When a whole is divided into seven equal parts and three parts are taken away, the fraction taken away is three – seventh and the other fraction not taken away is four – seventh.

In group of threes, the teacher trainees were given Cuisenaire Rods. The researcher instructed them to choose the orange rod as a whole. They should try and make up as many rows as they can use rods of one colour only. Each row must be of the same length as the rod you first chose (or orange rod) as illustrated in Fig 1 below.

<table>
<tr><td colspan="10">Orange</td></tr>
<tr><td colspan="2">Red</td><td colspan="2">Red</td><td colspan="2">Red</td><td colspan="2">Red</td><td colspan="2">Red</td></tr>
<tr><td>W</td><td>W</td><td>W</td><td>W</td><td>W</td><td>W</td><td>W</td><td>W</td><td>W</td><td>W</td></tr>
</table>

W = White

Fig. 1: Cuisenaire rod

From the diagram above, five rods make an orange rod. In fraction statement, a red is one fifth of the orange whole which is written as$\frac{1}{5}$. Also, ten white rods make and orange. In fraction statement, a white is one – tenth of the orange which is written as $\frac{1}{10}$.

Equivalent Fraction

The idea of equivalence occurs and every opportunity should be taken during discussing with teacher trainees. The idea should grow out of the teacher trainees' experience rather than being taught as a separate topic. It is helpful to draw together the various ideas which they have acquired.

Using Cuisenaire rods to teach equivalent fraction

The research instructed trainees to choose any rod or set of rods to be the "whole" for example Orange and Dark green make up as many rows as possible using rods of the a same colour only. For instance, all red or all brown. Each row must be of the same as the length as the original whole chose.

Method of Data Collection

The researcher used six weeks for the collection of the data. The first week was used to conduct the pre – test. Four weeks were used for the intervention and the last week was used for the post – test.

The Instrument Used

The instrument used for the study was teacher made tests. A pre-test was conducted to find out the problem's teacher trainees encountered when teaching fractions. A post-test was conducted after the intervention to find out whether they had really understood the concepts.

Validity and Reliability of Instruments

Saratakos (1998) describes face validity as when an instrument measures that it is supposed to measure. In this direction, the researcher made sure that the content of the questionnaire was based on what the research questions were set to find out. To ensure validity and reliability of instruments the researcher personally gave the questionnaire to the sampled teacher trainees. The items in the questionnaire were also simply made to ensure that the respondents understood them without any assistance from others.

Method of Data Analysis

The researcher based on the pre-test and post-test scores for the analysis. The Paired Sample t- test was used to analyze the data.

FINDINGS AND DISCUSSIONS OF RESULTS

In this chapter, the data collected from the teacher trainees of St. Joseph's College of Education, Bechem were analyzed and interpreted by the researcher. The data information includes those obtained from the responses to questionnaire, pre-test and post-test of the teacher trainees.

Analysis of Questionnaire of Teacher Trainees

Research Question 1: To what extent would the use of teaching and learning materials improve the teaching of fractions?

Table 1: Responses to the use of teaching and learning materials to improve the teaching of fractions. Note: SA represents Strongly Agree, A represents Agree, SD represents Strongly Disagree, D represents Disagree, F represents the number of teacher trainees who responded to the questionnaire.

Statement:	**SA (F) %**	**A (F) %**	**SD (F) %**	**D (F) %**
The use of Cuisenaire rods as a teaching learning material would greatly improve the teaching of fractions in mathematics	(30) 83.3	(6) 16.7	(0)0	(0)0
Teachers use Cuisenaire rods in teaching fractions in mathematics.	(0)0	(0)0	(30) 83.3	(6)16.7
Trainees understood the concept of fractions better when fractions rods were used as a teaching learning material.	(24) 66.6	(5)16.7	(0)0	(6) 16.7

Item 1 in the table 1 indicates that thirty (30) students representing eighty-three-point three percent (83.3%) of the sample and six (6) representing sixteen-point seven percent (16.7%) strongly agreed and agreed respectively that the use of Cuisenaire rods as a teaching learning material would greatly improve the teaching of fractions in mathematics.

This finding is contrast to what Bemett et al (2000) when they described ratio model and stress the use of Cuisenaire rods as helping to improve the understanding of fractions in mathematics. The finding revealed that the use of Cuisenaire rods as a teaching and learning materials greatly improve the understanding of the concepts of fractions. In analyzing item two (2) in table 1, it was realized that none of the respondent neither strongly agreed nor agreed that their teachers use Cuisenaire rods in teaching fractions in mathematics whiles thirty (30) representing eighty-three point three percent (83.3%) and six (6) representing sixteen point seven percent (16.7%) strongly disagree and disagree respectively to the statement.

This finding is contrast to the findings of Dirkes (1980) who mentioned that the use of concrete materials (of which Cuisenaire rod is an example) should be used by teachers to help the pupils to understand the concept of fractions better. It was realized that teaching was done in the abstract manner hence their inability to grasp the concept well. Item 3 in 1 which indicates the pupils understanding of the concept of fractions when Cuisenaire rods are used as teaching and learning materials was analyzed and twenty-four (24) representing sixty-six point six percent (66.6%) and other six (6) representing sixteen

point seven percent (16.7%) strongly agreed and agreed respectively to the notion whiles six (6) representing sixteen point seven percent (16.7%) disagreed to the notion. This finding is in agreement to Martin et al (1994) in citing Brunner (1989) who are on the opinion that a new concept must be learnt with concrete teaching learning material (such as Cuisenaire rods) as this would help learners to understand concept of fraction better. Students learn better when they interact with teaching and learning materials.

Research question 2: To what extent would the concept of equivalent fractions be used in solving addition and subtraction of fractions?

Table 2. Responses to the use of equivalent fractions in solving addition and subtraction of fractions

Statement:	**SA (F) %**	**A (F) %**	**SD (F) %**	**D (F) %**
The concept of Equivalent fractions can be used to solve addition of fractions.	(30) 83.3	(6) 16.7	(0)0	(0)0
The concept of Equivalent fractions can be used to solve subtraction of fractions.	(30) 83.3	(6) 16.7	(0)0	(0)0

Item l in the table 2. indicating the concept of equivalent fractions been used to solve addition of fractions was analyzed and it was realized that thirty (30) respondents representing eighty-three point three percent (83.3%) and six (6) respondents representing sixteen point seven percent (16.7%) strongly agreed and agreed respectively to the notion whiles none neither strongly disagreed nor disagreed to the notion.

The above finding is in line with Obeng (2005) who was of the opinion that equivalent fractions can be used to teach addition of fractions. The findings revealed that the teaching of addition of fractions is made easier when pupil's relevant previous knowledge in equivalent fractions is no doubt. Item 2 in table 2 indicating the concept of equivalent fractions which was used in solving subtraction of fraction was analyzed. Thirty (30) representing eighty-three-point three percent (83.3%) of the respondents strongly agreed to the notion whiles six (6) representing sixteen-point seven percent (16.7%) agreed to the notion, none however disagreed to the above-mentioned notion. This finding is also in agreement to Obeng (2005) when he mentioned that equivalent fraction can be used in the teaching of subtractions of fractions. The finding revealed that before subtractions in fractions are taught pupils should be conversant with equivalent fractions.

Research question 3: What are the difficulties teacher trainees encountered in addition and subtraction of fractions?

Table 3. Responses on the difficulties teacher trainees find to add and subtract fractions.

Statement:	SA (F) %	A (F) %	SD (F) %	D (F) %
Students can add fractions without much difficulties	(0)0	(24) 66.6	(6) 16.7	(6)16.7
Students can subtract fractions without much difficulties	(0)0	(24) 66.6	(6) 16.7	(6)16.7
Students do find question on fraction easy.	(0)0	(0)0	(36)100	(0)0

Item 1 in the table 3. which deals with the notion that students can add fractions without much difficulties indicates that twenty-four (24) respondents representing sixty-six-point six (66.6) percent agreed to the above notion whiles six (6) and another six (6) representing sixteen point seven percent 16.7% in each instance strongly disagreed and disagreed in both instances in the discussed notion. This finding is in contrast to Elizabeth (1988) when this author maintained that solvers to obtain an insight of the problem at hand enhance formulation of various strategies that will help the one solves the problem and aid one to construct proof of several theorems.

The finding indicated that sixty-six-point six percent of the students can add fractions when taking through the correct procedure. Item two (2) in table 3 indicated that twenty-four (24) respondents representing sixty-six-point six percent (66.6%) agreed that they could subtract fractions without many difficulties. Six (6) representing sixteen-point seven percent (16.7%) and another six (6) also representing another sixteen-point seven percent (16.7%) strongly disagreed and disagreed respectively to the notion. This finding is in contrast to the notion Elizabeth (1988) made when this author mentioned that the use of diagrams can make some classifications which young children have done, which facilitate knowledge building and enhance formulation of various strategies that will help in solving problems and aid one to construct proofs of several theorems. Sixty-six-point six percent of the trainees indicated that they could subtract fractions without much difficulty. Item three (3) in the table 3 indicates that all the thirty-six (36) respondents representing hundred percent (100%) strongly disagreed that students find questions in fractions easy to solve. This analysis is in agreement to Dolan (2000) when these authors mentioned that even though the teaching of fractions demand a greater amount of time, student find it difficult to understand the concept of fractions and stressed that, in view of this problem students enter high school with relatively poorer understanding of fractions. The finding shows that trainees find it difficult in solving fractions. In most cases they add the numerators and denominators.

Research question 4: To what extent would the teacher trainees be able to divide whole numbers by fractions?

Table 4. Responses on whether students would be able to divide whole numbers by fractions.

Statement:	SA (F)%	A (F) %	SD (F) %	D (F) %
Teacher trainees can divide whole numbers by fractions without much difficulties.	(0)0	(0)0	(30) 83.3	(6)16.7
Whole numbers cannot be divided by fractions without teaching learning materials	(0)0	(0)0	(36)100	(0)0
Teacher trainees do not under stand the concept of dividing Whole numbers by fractions.	(36)100	(0)0	(0)0	(0)0

Item 1 in the table 4 indicates that while none agreed to the motion thirty (30) respondent representing eighty-three point three percent (83.3%) of the respondent and six (6)representing sixteen point seven percent (16.7%) of respondent strongly disagreed and disagreed respectively to the statement that teacher trainees can divided the whole numbers by fractions without much difficulties. The above findings are in agreement to what Paling (1996) mentioned. This author mentioned that even though pupils spend long hours on learning fractions, they do not appear understand what they learn at the end of the day. The findings revealed that eighty-three-point three percent of students divide whole numbers with much difficulty. In view of this, the use of concrete materials should be used to enable them grasp the concept.

Item two (2) which denotes the notion that whole numbers cannot be divided by fractions without teaching learning material was analyzed. It was realized that while none neither strongly agreed nor agreed to the assertion all the thirty-six (36) respondents representing hundred percent (100%) disagreed strongly to the assertion. The above finding is in contrast with Dirke (1980) who emphases that concrete objects and illustrations be used to enhance better understanding of what they are to learn. All the students strongly disagreed to the notion because they teach in abstract. Trainees should be encouraged to teach from concrete, semi concrete before teaching in abstract. Item three (3) in table 4 which denotes to the assertion if teacher trainees do not understand the concept of division of fractions by whole numbers. In analyzing the above assertion, it was realized that thirty-six (36) respondents representing hundred percent (100%) strongly agreed to the assertion. This finding is in agreement to Paling (1996) who was of the opinion that even though pupils spend a lot of hours on the study of fractions they do not appear to understand what they have learnt at the end of the day. The concept of dividing whole numbers by fraction is not well understood. However, when trainees are taking through a step-by-step approach the concept will be understood.

Research Question 5: What difficulties do teacher trainees encounter in using Cuisenaire rods in multiplication of unlike fractions?

Table 5: Responses on difficulties trainees encountered in multiplying unlike fractions using a named concrete material.

Statement:	SA (F) %	A (F)%	SD (F) %	D (F) %
Teacher trainees can easily multiply two unlike fractions without any teaching learning materials.	(0)0	(6)16.7	(24) 66.6	(6)16.7
Teacher trainees cannot easily multiply two unlike fractions with the help of teaching learning materials.	(0) 0	(0) 0	(30) 83.3	(6)16.7
Cuisenaire rods is one of the effective teaching learning materials teacher trainees can use to teach fractions.	(30)83.3	(6) 16.7	(0)0	(0)0

Item 1 in table 5. which talks about the assertion that teacher trainees can easily multiply two unlike fractions without any teaching learning materials was analyzed. It was realized through the analysis that while six (6) respondents representing sixteen-point seven percent (16.7%) agreed to the assertion. Twenty-four (24) representing sixty-six-point six percent (66.6%) strongly disagreed to the assertion while six (6) respondents representing sixteen-point seven percent (16.7%) disagreed the assertion. The above finding is in agreement to Dolan (2000) who were of the opinion that despite the many hours spent on teaching and learning of fractions, most students appear not to understand the concept. Trainees strongly disagree because it will encourage the learning by rules so they should use learning materials. Item 2 in table 5 indicates that while none neither agreed nor strongly agreed, thirty (30) respondents representing eighty-three-point three percent (83.3%) strongly disagreed while six (6) respondents representing sixteen-point seven percent (16.7%) disagreed that teacher trainees could easing multiply two unlike fractions without teaching learning materials. The above finding is in agreement to Dirke (1980) who is of the view that the use of concrete objects and illustrations enhance the understanding of whatever concept they have leant. The finding shows that trainees can easily multiply two unlike fractions with the help of teaching learning materials so they should be encouraged to use concrete materials. Item 3 in table 5 indicates the notion that Cuisenaire rods is one of the most effective teaching learning materials teacher trainees can use teaching and learning of fractions. Out of the thirty-six (36) respondents, thirty (30) representing eighty-three-point three percent (83.3%) and six (6) representing sixteen-point seven percent (16.7%) strongly agreed and agreed respectively to the above nation while none disagreed. This finding is in agreement to what Barnett et al (2000) when they stress that the use of Cuisenaire rods enhances the understanding of the

concept of fractions. The finding indicated that, the Cuisenaire rod is one of the effective teaching learning materials and students should be encouraged to use it.

Analysis of Pre-Test and Post-Test Scores

The table below shows the marks of teacher trainees in pre-test and post-test after they have been given ten questions to answer in each situation. Both tests were administered under normal examination conditions to ensure that the students do not copy from each other. The table below shows the scores obtained by the teacher trainees for the pre-test and post-test.

Table 6: Scores on pre-test and post-test

STUDENT	PRE-TEST	POST-TEST	STUDENT	PRE-TEST	POST-TEST
1.	***1***	5	19	3	5
2.	2	5	20	4	10
3.	2	7	21	5	10
4.	4	8	22	0	6
5.	5	10	23	6	10
6.	4	8	24	5	10
7.	3	5	25	2	6
8.	0	6	26	3	8
9.	6	8	27	0	6
10.	2	8	28	2	7
11.	3	6	29	3	6
12.	4	10	30	4	8
13.	5	10	31	3	8
14.	2	6	32	0	2
15.	3	7	33	2	6
16.	3	8	34	3	7
17.	0	2	35	4	8
18.	4	9	36	2	5

Analysis of the Pre-Test Result

Looking at the raw scores of the post-test, it was realized that no teacher trainee had all the ten (10) questions correct, only two (2) teacher trainees representing (6%) out of thirty-six (36) trainees scored six (6) marks out of the ten questions. Four (4) trainees representing (11%) had half of the marks that is five (5) and twenty-five (25) trainees (64%) had four (4) up to one (1) and five (5) trainees (14%) had zero (0). A critical study 8 at the pre-test scores showed that the overall performance was not encouraging.

Analysis of the Post-Test Result

An observation of the post-test scores showed that the general performance was encouraging. Seven (7) trainees representing (11%) were able to score all questions given them. Twenty-nine (29) trainees scored six (6) and above representing (81%) while only seven (7) trainees out of the thirty-six (36) scored five (5) and below representing 19%. Since more trainees scored higher marks in the post-test then in the pre-test, it means there has been an

improvement in their performance as a result of the intervention put in place by the researcher.

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Table 7: Paired Sampled Statistics

	MEAN	N	STANDARD DEVIATION	STANDARD ERROR MEAN
Pair Post-Test	7.11	36	2.07	0.35
Pre-Test	2.89	36	1.64	0.28

Table 8: Paired Samples Correlation

	N	CORRELATION	SIG.
Pair post-test and Pre-test	36	0.796	0.000

Table 9: Paired Samples Test

	Paired Differences							
St. Error				95% confidence Interval of the difference				
	Mean	St. Devi.	Mean	Lower	Upper	T	df	sig
Pair Pretest and Post-Test	4.22	1.27	0.21	3.79	4.66	19.988	35	0.00

A study of table 7 shows that the mean and the standard deviation on the pre-test were 2.89 and 1.64 respectively. While that of the post-test was 7.11 and 2.07 respectively. This shows a remarkable improvement in the post-test and there was a strong correlation between the post-test and pre-test.

Test

The null hypothesis H_0 is: there is no difference in scores on the pre-test and post-test questions. The alternative hypothesis H_1 is: there is a difference in scores. From tables 7, 8 & 9 above the null hypotheses is rejected and conclude that the performance on the post-test is statistically significantly different from that on the post-test. Hence the alternative hypothesis H_1 is accepted.

Summary of Major Findings

Below are the major findings of the research work.

- The findings revealed that the use of teaching and learning materials (Cuisenaire rods) greatly improve the teaching of fractions in mathematics.
- The findings further revealed that before teacher trainees could grasp the concept of addition and subtraction of fractions, the concept of equivalent fractions should be well understood.
- The findings also revealed that teacher trainees lack the understanding of the subject matter as related to everyday life.
- Finally, it was also realized that teacher trainees grasp the concept of fraction well when they are taken through the procedure from concrete through semi-concrete and finally to the abstract.

Implications for Practice

From the analysis and discussion of the data, the findings of the study have the following important educational implications;

- Teacher trainees should be encouraged to use teaching and learning materials to teach when introducing a concept like fractions.
- The above implication is an agreement to Martin et al (1994) in citing Brunner (1989) when they revealed that it is the duty of the teacher to use concrete materials to introduce fraction first and gradually produced to pictures and diagrams, that is from concrete to semi-concrete and finally to the abstract stage.
- The concept of Equivalent fractions should be taught first before addition and subtraction of fractions are taught. This implication is in agreement to Obeng (2005) when stated that addition or subtraction with different denominators are first express as equivalent fractions before solving them.
- The language used should be very simple and be at the level of learners. This implication is in agreement to Williams (1986) when this author viewed the language of the teacher as very important if he or she is to make positive impact on his or her learners. This author stated that mathematics language should be carefully and accurately used from the beginning. For instance, the fraction ¾ should be described in words as three-fourths. The phrase such as three over four should be avoided.

CONCLUSION

The concepts of fractions should be well explained to students by using the appropriate teaching and learning materials.

- A child -centered approach of teaching was used to enable teacher trainees follow instructions. They were also engaged in activities and asked questions to discover things for themselves.
- The language used in communicating to learners is important if teachers want to make a lasting impact on the learners. Expressions such as ‘four over six’ and ‘two over seven’ should be avoided.

In conclusion, there is no guaranteed way of making sure students learn, but if they are well motivated and the information is presented in a visible structure using interesting and the appropriate teaching and learning materials then students will perform better.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed for consideration.

- The use of teaching and learning materials should be used to introduce lessons to enhance the concept of topic being taught.
- Mathematics lesson should be related to real life experiences.
- Students should work in pairs or groups when necessary. This will enable them to exchange ideas freely in class.
- Great emphasis should be laid down on the systematic approach of taking teacher trainees through fractions and more exercises must be given to teacher trainees to practice since practice makes man perfect.
- Teaching methods should be varied.
- Workshops, seminars and conferences must be organized frequently to enable teacher trainees to be abreast with new innovations of the subject matter.

Suggestions for Further Research

Further research work on fractions should involve regular students in the colleges of education in Ghana.

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