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Effect of visual-based instruction on elementary pre-service teachers' conceptual understanding of fractions

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ABSTRACT

Research from different settings show that many elementary school teachers lack a deep conceptual understanding of fractions. A quasi-experimental research was carried out to determine the effectiveness of visual-based instruction on elementary pre-service teachers' (PST) conceptual understanding of fractions. Data from 97 first-year PSTs at a college of education were collected using an achievement test on the concepts and operational procedures of fractions. Test scores were analysed using descriptive statistics, and the independent samples t-test. The average change in performance from the pre-test to the post-test was assessed using a normalized gain ⟨g⟩ for each instructional approach. While the difference was not statistically significant, the computed normalised gains show that the visual-based instruction yielded better results than the traditional lecture method. These findings demonstrate a need for raising awareness among pre-service and in-service elementary school teachers on the effectiveness of visual-based instructional approaches for enhancing learners' understanding of fractions.

Keywords: fractions, pre-service teachers, visual-based instruction

INTRODUCTION

Mathematics education research is well-stocked with studies that have highlighted the centrality of fractions and their role in mathematics learning (de Castro, 2008; Siegler et al., 2013; Torbeyns et al., 2014). It has further been demonstrated that fractions are important because of their inherent role in more advanced mathematics courses such as algebra (Wu, 2009) and the theory of numerical development (Siegler et al., 2011). This demonstrates that knowledge of fractions is not only a pre-requisite for understanding various advanced mathematics topics but is also needed for most tasks in everyday life situations.

According to Mathnasium (2017, para. 9), a study conducted in 2012 by Bob Siegler and colleagues found that "a child's knowledge of fractions in fifth grade predicts performance in high-school math classes, even after controlling for IQ, reading achievement, working memory, family income and education, and knowledge of whole numbers". The same study further concluded that a student's failure to understand fractions may render impossible, their understanding of algebra, geometry, chemistry, statistics and probability, and physics, among others.

Based on the foregoing, determination of the degree to which elementary school teachers (both in-service and pre-service) understand and teach fractions becomes paramount. Siegler et al. (2013, p. 21) stressed a need for "professional development programs that aim at improving teachers' understanding of fractions and how to teach them". Likewise, Sunzuma et al. (2022) have stressed a need for the implementation of relevant teaching methods in initial teacher training programs that are well-aligned with the constructivist school mathematics curriculum. In this sense, we argue that both in-service and pre-service teachers need to have a thorough understanding of fraction concepts and operations for them to teach learners effectively. Teachers should also be knowledgeable about the types of errors and alternative conceptions that students are likely to generate during fraction instruction.

Despite the centrality of fractions in mathematical learning, research conducted in different settings demonstrate that both elementary school teachers (Chinnappan & Forrester, 2014; Newton, 2009) and learners (Ayieko et al., 2022; Mahama & Kyeremeh, 2023; Makhubele, 2021) lack a deep conceptual understanding of fractions. Even in countries such as Japan and China, where the majority of students do achieve reasonably good conceptual understanding, fractions are considered a difficult topic (Fazio & Siegler, 2011). Nonetheless, the situation is more prominent in the context of Africa. A recent cross-national assessment by Ayieko et al. (2022) revealed that participating African countries had a substantial proportion of learners with inadequate understanding of fractions at both the fourth (60%) and eighth (42.6%) grade levels.

In Zambia currently, the proficiency of pupils on fractions is of great concern. Candidates' limited understanding of fractions has been reported in national examination performance reports at both lower and upper secondary levels of education (Examinations Council of Zambia, 2016, 2018). Generally speaking, some of these performance reports and other studies conducted in Zambia (Mukuka et al., 2019a, 2020; Nakawa, 2012) have partly attributed the students' low achievement in mathematics to the type of assessment and instructional approaches teachers use in their mathematics classrooms. Similarly, a systematic review of literature by Luneta (2022) identified poor quality of pre-service teachers, teacher educators, and the old teacher education curriculum alongside ineffective instructional approaches as being responsible for this quality landscape in mathematics education. Such revelations raise questions about the effectiveness of teaching and learning going on in classrooms. Furthermore, the competencies and attitudes of the pre-service teachers towards learning fractions are of great concern.

With this background, it was hypothesised that a visual-based instructional approach would enhance pre-service teachers' conceptual understanding of fractions. Therefore, answers to the following research questions were sought:

1. To what extent do elementary pre-service teachers understand the concepts and operational procedures on fractions?
2. Do pre-service teachers exposed to visual-based instruction possess a better understanding of fractions than those exposed to the traditional lecture method?

This study was designed to determine the best practices among pre-service teachers that can lead to improved performance and a deep understanding of fractions using visual-based learning.

METHOD

Research Design and Sample Selection

The purpose of this research was to investigate the effect of visual representation of fractions on pre-service teachers' conceptual understanding. Furthermore, there was a need to establish the knowledge of pre-service teachers on fractions and determine their attitudes towards fractions. A quasi-experimental research was adopted using a pre-/post-test control group design. A quasi-experimental research design was preferred because two assembled classes were randomly selected from 12 first-year classes at a college of education in the Northern Province of Zambia. The total number of first-year students was 600. Each of the two selected classes had 50 students. However, only 97 student teachers participated in the study. Of this number, the control group comprised 47 student teachers whereas the experimental group consisted of 50 student teachers.

Instructional Approaches Involved

After the selection of the two classes, a pre-test was administered to all the participants after which the control group was taught using the traditional lecture method while the experimental group was taught using a visual-based instructional approach. Student teachers from both groups learned the same topic (fractions) for three weeks (four hours per week) using similar examples and notes. Thereafter, a post-test was administered to all the participants.

In the visual-based instruction, the teacher used teaching aids which students were able to manipulate to get the concept. Teaching and learning aids involved cutting papers into various fractions and sharing whole objects into specified proportions as a practical way of comparing fractions. Thereafter students were requested to translate the practical cuttings into fractions and perform the basic operations. The emphasis was on ensuring hands-on activities for all students. Other visual aids included the diagrams drawn on the chalkboard and flip charts. Computer-generated diagrams on fractions were also availed to the learners through PowerPoint presentations.

On the other hand, the traditional lecture method involved teacher exposition in which the lecturer explained fraction concepts and procedures. Here students were drilled to workout fractions using various methods as demanded by the syllabus. The lecturer demonstrated several fractional problems on the chalkboard while students were taking down the notes for future reference. Enough problems were given to students to ensure mastery of the specified content. Only one lecturer was asked to teach both classes. To ensure that the lecturer was not biased towards one group, guidance was given before the commencement of the experiment. Monitoring in both classes was done regularly to minimise the chances of biasness. Furthermore, lessons were placed at the same time though on different days. Each group had one double class at 08 hrs and the other one at 10:30 hrs per week.

Research Instruments

A knowledge test on fractions was used to collect data for addressing the two research questions (**Appendix A** and **Appendix B**). Before administration to the intended participants, the test items were validated by experts and then refined by the researchers. The purpose of subjecting this instrument to validation was to ensure that all the items included were in line with the research purpose and the mathematics education curriculum for the Zambian primary school teacher training program.

Both pre- and post-test consisted of questions that demanded students' explanations of the meaning of concepts like the numerator, denominator, and equivalent fractions. The procedure for solving problems on fractions using combined operations was also tested. Also, evaluating and simplifying fractions using diagram form was tested to assess students' proficiency in diagram interpretations. The problems involved arranging fractions on a number line, getting equivalent fractions using fractional charts. The actual test items have been included in the appendix section. Almost all the questions in the pre-test were retained in the post-test except for a few that were only meant to establish students' knowledge of fractions before the intervention. In other words, post-test was structured in such a way that some questions were retained while others were replaced and rearranged.

Table 1. Number of correct solutions/answers for each question in pre-test

Question	Traditional lecture (n=47)		Visual-based Instruction (n=50)	
	Count	Percent	Count	Percent
1(a)	44	93.6	42	84.0
1(b)	44	93.6	41	82.0
2(a)	9	19.1	5	10.0
2(b)	0	0.0	1	2.0
3(a)	34	72.3	38	76.0
3(b)	7	14.9	15	30.0
4	0	0.0	0	0.0
5	15	31.9	17	34.0
6	4	8.5	1	2.0
7(a)	9	19.1	2	4.0
7(b)	3	6.4	0	0.0
7(c)	3	6.4	0	0.0
8	30	63.8	4	8.0
9	24	51.1	3	6.0

Data Analysis

Scores from the knowledge test on fractions were analysed using descriptive statistics such as frequencies, mean, and standard deviation. To test the efficacy of the visual-based approach on pre-service teachers' understanding of fractions, an independent samples t-test was used. To determine the magnitude of change in performance from the pre-test to the post-test, a normalized gain for each teaching method was computed. Hake (1998) introduced normalized gain as a measure of change between pre- and post-test scores when the same concept test is used to assess students' conceptual understanding. The normalised gain, denoted by ⟨g⟩ is defined as "the change in the class average score divided by the maximum possible gain" (Coletta, 2020, p. 1). Hence, the normalised gain was calculated using the following formula:

$$\langle g \rangle = \frac{posttest\ mean\ score - pretest\ mean\ score}{maximum\ score - pretest\ mean\ score}.$$

Although the use of normalised gain has been criticized by some authors like Nissen et al. (2018) due to what they referred to as "prescore biasness", Coletta (2020) has provided enough evidence on why the normalised gain should be used to assess the educational effectiveness of a particular method of teaching. While they emphasised the use of a normalised gain in physics education research, we believe that this statistic can also yield similar results in mathematics education research especially that physics concepts are closely related to mathematics concepts. Finally, document analysis of pre-service teachers' answer scripts was carried out to identify the emerging themes and information gaps that pre-service teachers exhibited on concepts related to fractions.

RESULTS

The findings of this study are presented according to the research questions stated in the introduction.

Research Question 1

To determine the extent to which pre-service teachers understood the concepts and procedures on fractions, their test scripts before and after the intervention were analysed to determine the proportion of students who got a particular question correctly. **Table 1** illustrates the proportion of participants who answered a particular question correctly. Results displayed in **Table 1** reflect that most participants did not have many challenges with the addition and subtraction of fractions as more than 82% of the respondents from both groups managed to answer questions 1(a) and 1(b) correctly.

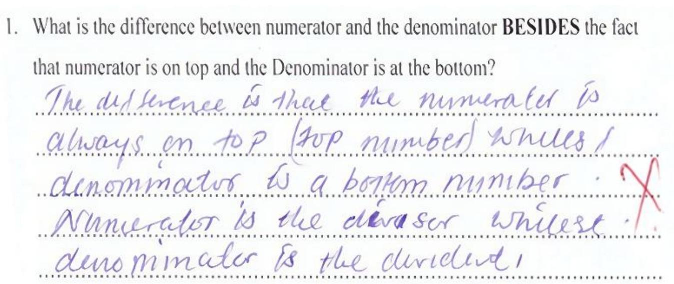
Results displayed in **Table 1** further indicate that the participants had difficulties in ordering fractions, evaluating fractions with combined operations, word problems, and the application of fractions to real-life situations. Regarding pre-test, participants who were assigned to the traditional lecture method seemed to possess a better understanding of fractions than their counterparts who were assigned to the visual-based instruction. However, it should be noted that questions that were easier for one group were also easier for the other group. The Pearson correlation coefficient also revealed a strong, positive, and significant relationship ($r=.84$, $p<.001$) in the number of correct solutions/answers from both groups. This shows that students had previously been exposed to similar concepts on fractions despite some differences in their cognitive abilities.

After exposure to two different modes of teaching (traditional lecture method and visual-based instruction), a post-test was given to the participants from both groups. As stated earlier, most of the questions included in the pre-test were retained in the post-test but in a different order. Pre-service teachers' conceptual understanding, procedural proficiency, and computational skills were all investigated. **Table 2** illustrates the number of correct solutions/answers for each question in the post-test.

Results displayed in **Table 2** indicate that a larger proportion of students from the visual-based instruction group were able to answer most of the questions correctly than their counterparts in the traditional lecture method. This was the case for questions 2, 3, 4, 5, and 6 that tested students' understanding of equivalent fractions, evaluation of fractions using the number line and rectangular blocks, ordering fractions, and using combined operations on simplifying fractions.

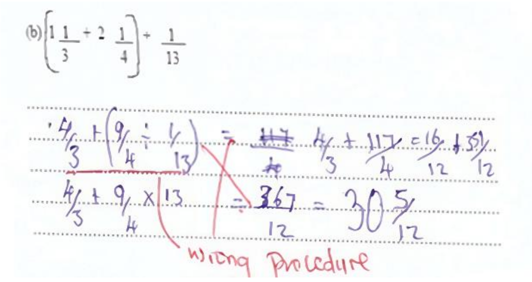
Table 2. Number of correct solutions/answers for each question in post-test

Question	Traditional lecture (n=47)		Visual-based Instruction (n=50)	
	Count	Percent	Count	Percent
1	2	4.3	5	10.0
2	24	51.1	30	60.0
3(a)	5	10.6	27	54.0
3(b)	7	14.9	21	42.0
4	25	53.2	39	78.0
5	3	6.4	10	20.0
6	15	31.9	15	30.0
7	1	2.1	9	18.0
8(a)	4	8.5	5	10.0
8(b)	3	6.4	4	8.0
8(c)	1	2.1	4	8.0


1. What is the difference between numerator and the denominator **BESIDES** the fact that numerator is on top and the Denominator is at the bottom?

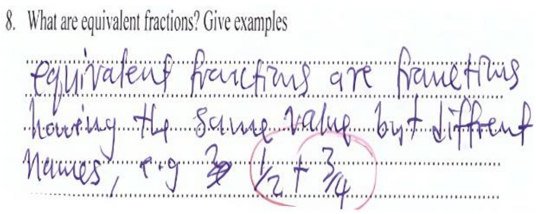
The difference is that the numerator is always on top (top number) whiles denominator is a bottom number. Numerator is the divisor whilest denominator is the dividend.

Figure 1. Students understanding of the numerator and denominator (Source: PST's Answer Script for Post-test)


(b) $\left[1\frac{1}{3} + 2\frac{1}{4}\right] \div \frac{1}{13}$

Wrong Procedure

Figure 2. Application of combined operations on fractions (Source: PST's Answer Script for Pretest)


8. What are equivalent fractions? Give examples

equivalent fractions are fractions having the same value but different names, e.g 1/2 + 3/4

Figure 3. Students' understanding of equivalent fractions (Source: PST's Answer Script for Pretest)

On the other hand, it was observed that students from both groups performed poorly on questions 1, 7, and 8 that demanded their conceptual understanding of the terms like, numerator, and denominator, application of combined operations on fractions, and the application of the knowledge of fractions to real-life situations. Examples of students' misconceptions and limited understanding of such concepts are displayed in **Figure 1**, **Figure 2**, and **Figure 3**.

The work presented in **Figure 1** shows that this particular student only knows that the numerator is on top while the denominator is at the bottom. It further demonstrates that the mathematical meaning of these concepts is not clearly understood. About 75% of the total participants failed to demonstrate the understanding of fraction concepts in terms of the numerator and denominator.

Figure 2 also illustrates a student's failure to apply operations in the correct order. When dealing with expressions containing more than one operation, a respondent needs to begin by dealing with brackets, followed by division, multiplication, addition, and finally subtraction. This procedure is usually referred to as BODMAS.

The excerpt shown in **Figure 2** reflects a student's incorrect use of the order of operations. This means that the student did not understand how the idea of BODMAS works but simply knows that this idea works. About 47% of the participants from the traditional lecture method group displayed such deficiencies while 22% of the participants from the visual-based instruction showed such misconceptions.

Table 3. Descriptive statistics

Measure	Teaching method	Sample size	M	SD
Pre-test	Traditional lecture method	47	32.8	13.9
	Visual-based Instruction	50	26.8	10.5
Post-test	Traditional lecture method	47	33.7	16.9
	Visual-based instruction	50	36.0	17.9

It was further noted that some pre-service teachers memorized certain concepts without understanding. The excerpt displayed in **Figure 3** provides some evidence that demonstrates that the concept of equivalent fractions might have been superficially fixed or learned by rote. The excerpt presented in **Figure 3** reveals that a student only memorised the definition of equivalent fractions without a clear understanding of the concept. The student managed to correctly define the concept of equivalent fractions but gave the wrong examples. This demonstrates a lack of understanding of the concept.

Research Question 2

To determine the efficacy of visual-based instruction on pre-service teachers' understanding of fractions, a pre-test was administered to all the students in both the control group (traditional lecture method) and the experimental group (visual-based approach). After pre-service teachers' exposure to the two different learning modes, a post-test was administered. **Table 3** displays the descriptive statistics (mean, M, and standard deviation, SD) for both groups at both levels of assessment (pre- and post-test). To test the significance of the differences at both the pre- and post-test levels, an independent samples t-test was performed with the assumption of equal variances between the groups following Levene's test results for homogeneity of variances between the control and experimental groups. In terms of the pre-test, results displayed in **Table 3** indicate that pre-service teachers who were assigned to the traditional lecture method (M=32.8, SD=13.9) outperformed their counterparts in the visual-based instructional approach (M=26.8, SD=10.5). This difference was significant, t(95)=2.41, p=.018.

After the intervention, results show that pre-service teachers who were taught using the visual-based approach (M=36, SD=17.9) performed better than students who were taught using the traditional lecture method (M=33.7, SD=16.9). However, this difference was not significant, t(95)=-0.65, p=.517. Despite this non-significant difference, the group that was exposed to the visual-based instruction showed a substantial improvement in their understanding of fractions compared to their colleagues who were exposed to the traditional lecture method.

Based on the classification of high, moderate, and low normalised gain values (Hake, 1998), findings of the present study indicate that both the traditional lecture method, $\langle g \rangle = 0.014$, and the visual-based instruction, $\langle g \rangle = 0.126$ gave low values of the normalised gain. While the calculated normalised gains do not reflect a significant improvement in pre-servie teachers' understanding of fractions, it suffices to point out that visual-based instruction yielded better results than the traditional lecture method especially that the experimental group was significantly lower than the control group during the pre-test.

DISCUSSION OF RESEARCH FINDINGS

The primary goal of this research was to investigate the effectiveness of a visual-based teaching approach on pre-service teachers' conceptual understanding of fractions. One of the compelling grounds for undertaking this research was pupils' poor performance on fractions at both primary and junior secondary levels of education. Various chief examiner's reports have persistently revealed that the areas of difficulties for learners have also been the areas of difficulties for teachers. This means that the problem is more to do with the teachers because they cannot facilitate the acquisition of knowledge that they do not possess.

Regarding the extent to which pre-service teachers understood fractions, research findings have revealed pre-service teachers' limited understanding of fractions. For instance, the concept of numerator and denominator form up a fraction, and a teacher is expected to fully understand them, especially that the conceptualisation of these two terms makes the starting point in understanding fractions (Fazio & Siegler, 2011). It has also been revealed that the majority of participants memorised the definitions and did not exhibit a deeper understanding of the concepts. As a result, they were able to correctly recite the definitions but provided wrong examples. This narrow understanding of concepts was also reflected in their failure to carry out certain operational procedures correctly. These findings echo those of Rosli et al. (2020) who found that the selected preservice teachers exhibited low content knowledge on fraction-related concepts such as, "unit-whole, part-whole, equivalent area, arithmetic operations, and ordering fractional values". Results of the present study are also consistent with the findings of a study by Joshua and Lee (2022) that revealed inadequate proportional reasoning and low conceptual understanding of quantities among elementary pre-service teachers. This is why mathematics teacher educators need to make sure that students understand fractions for them to teach the concept effectively when they are professionally qualified. There is also a need for teacher educators to consider employing relevant instructional approaches that would enable pre-service teachers to teach effectively when they become professionally qualified (Banda et al., 2021; Sunzuma et al., 2022).

Results have also shown that the majority of research participants could not manage to apply the knowledge of fractions to real-life situations. This demonstrates a need for teacher educators to orient pre-service teachers on the application of mathematical knowledge to various practical situations. The Zambian school mathematics curriculum expects that learners should be able to apply mathematical knowledge in solving real-life situation problems. This demonstrates a need for teachers to design mathematical tasks that would increase learners' ability to translate practical situations into mathematical terms and vice versa, not only on fractions but also on other topics like algebra (Mukuka et al., 2019b, 2020) and geometry (Niyukuri et al., 2020).

Although the performance of pre-service teachers who were assigned to the visual-based instruction was not significantly higher than that of their counterparts in the traditional lecture group, it has been established that the visual-based approach showed more promise in strengthening students' conceptual understanding of fractions. These findings echo those of previous research (Lee & Lee, 2019; Rau & Matthews, 2017; Rosli et al., 2020) that found the use of concrete models, and other visual representations to have a significant effect on enhancing preservice teachers' conceptual and procedural understanding of fractions. Another study by Sahin et al. (2022) established that pictorial modelling strategies offered more promise to the development conceptual understanding of fraction division with remainders. This is why many scholars have stressed a need for designing mathematics education courses that would incorporate visual-based instructional approaches for strengthening pre-service teachers' pedagogical content knowledge.

Study Limitations and Future Directions

Findings of the present research have revealed that the control group exhibited a better understanding of fractions than the experimental group before the intervention. After exposing the control group to the traditional lecture method and the experimental group to the visual-based instructional approach, an independent samples t-test revealed no significant difference in pre-service teachers' conceptual understanding between the two groups. However, the normalised gain for the experimental group was higher than that of the control group. This demonstrates that pre-service teachers exposed to the visual-based instruction exhibited a better understanding of fractions than their counterparts in the traditional lecture method.

While we strongly recommend the use of a visual-based instructional approach for enhancing students' understanding of fractions, we wish to state that the present study is contextually-bound and may not be generalised to other contexts. The geographical and socio-economical demographic factors of the present research site and research participants may not be representative of all the colleges and pre-service teachers in Zambia. Besides that, a quasi- experiment assumes the homogeneity of the control and experimental groups before the intervention, which was not the case for the present research. These limitations might have led to a failure to control for some threats to internal validity and other confounding variables that might have affected the research findings. In light of this, future studies may involve different colleges to increase the chances of generalising the research findings to other contexts.

There is also a need for more continuing professional development workshops for in-service teachers on how they can effectively use visual-based approaches to enhance students' understanding of fractions. Further research on other active learning approaches that can supplement the achievement effects of visual-based instruction is also needed.

CONCLUSION

In line with some previous studies, the present research has demonstrated that fractions are a cornerstone of mathematics. It has been highlighted that teacher trainers ought to be well-versed with the knowledge of fractions. The outcome of the present research is that visual-based instruction is better than the traditional lecture method. This could be attributed to the fact that the visual-based instruction showed more improvement in pre-service teachers' knowledge acquisition of fractions. In light of these findings, more emphasis and illustrations should be given on how to interpret a fraction with practical examples on concepts like numerators, denominators, and equivalent fractions. Teacher trainers should make every good effort to ensure that pre-service teachers are well-equipped with the knowledge of fractions for them to teach the concept effectively when they become qualified teachers. Visual-based tools and games must be provided to students for them to have a deeper understanding of fractions and their applications to various practical situations.

By revealing pre-service teachers' areas of difficulties in understanding fractions, this research provides a basis for future studies that would aim at strengthening students' conceptual knowledge of fractions. Findings of this study also provide evidence on the need for mathematics teacher educators to ensure that elementary mathematics teachers in making are well-equipped with both the content knowledge of fractions and the effective implementation of visual-based instruction in mathematics classrooms. While most previous studies have only revealed pre-service teachers' knowledge gaps on fractions, this study has provided evidence on the effectiveness of visual-based instruction for enhancing pre-service teachers' conceptual understanding of fractions.

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Ethical statement: Authors stated that before data collection, Copperbelt University's School of Mathematics and Natural Sciences' "Research and Ethical" Committee gave its approval. The participants were informed of the goal of the study and afterwards gave their written consent prior to data collection. No participants' names have been revealed, and all ethical standards have been followed.

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

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APPENDIX A

Knowledge Test on Fractions (Pre-Test)

Dear respondent,

This test is designed to collect data on student teachers' existing conceptual knowledge of fractions. The data collected will help the researchers to compile a report for academic purposes and to inform the practitioners and policy makers on the best practices to enhance students' conceptual understanding of the topic in question. You are being assured that the information you supply will be treated with the greatest confidentiality it deserves and it is meant for only academic purposes.

Instructions

Duration: 30 minutes

(a) There are nine questions in this paper. Answer all the questions completely.

(b) Do not write your name on this paper.

1. Evaluate each of the following:

   (a) $\frac{1}{6}+\frac{3}{4}$

   (b) $1\frac{3}{4}-\frac{2}{3}$

2. Evaluate each of the following:

   (a) $3\times\frac{2}{5}$ using number line.

   (b) $\frac{1}{4}\times\frac{2}{3}$ using rectangular blocks.

3. Evaluate the following fractions.

   (a) $\frac{4}{9}\div\frac{2}{3}$

   (b) $\left(1\frac{1}{3}+2\frac{1}{4}\right)\div\frac{1}{13}$

4. Place the following fractions on a number line:

   $\frac{3}{4},\frac{8}{8},\frac{1}{2},\frac{7}{8},\frac{12}{16}$

5. Arrange the following fractions in ascending order:

   $\frac{5}{6},\frac{1}{2},\frac{7}{12},\frac{9}{10}$

6. Evaluate the following:

   $5\frac{1}{2}-\frac{2}{3}\times 3\frac{1}{4}+\frac{3}{8}$

7. Two-third of the members of the class lives in New town compound and of these $\frac{1}{4}$ live in location.

   (a) What fraction of the class lives in location?

   (b) If there are eight members of the class from New town, how many members are in class?

   (c) How many members of the class neither live in New town nor location?

8. What are equivalent fractions? Give examples.

9. What do you understand by the concept '**fraction**'.

THANK YOU FOR YOUR PARTICIPATION!

APPENDIX B

Achievement Test on Fractions (Post-Test)

Dear respondent,

This test is designed to collect data on student teachers' existing conceptual knowledge of fractions. The data collected will help the researchers to compile a report for academic purposes and to inform the practitioners and policy makers on the best practices to enhance students' conceptual understanding of the topic in question. You are being assured that the information you supply will be treated with the greatest confidentiality it deserves and it is meant for only academic purposes.

Instructions

Duration: 30 minutes

(a) There are eight questions in this paper. Attempt all the questions completely.

(b) Do not write your name on this paper.

SECTION A

1. What is the difference between the numerator and the denominator **besides** the fact that numerator is on top and the denominator is at the bottom?

2. What are equivalent fractions?

3. Evaluate the following:

   (a) $3 \times \frac{2}{5}$ using number line.

   (b) $\frac{1}{4} \times \frac{2}{3}$ using rectangular blocks.

4. Evaluate the fraction:

   $\left(\frac{1}{3} + 2\frac{1}{4}\right) \div \frac{1}{13}$

5. Place the following fractions on a number line:

   $\frac{3}{4}, \frac{8}{8}, \frac{1}{2}, \frac{7}{8}, \frac{12}{16}$

6. Arrange the following fractions in ascending order:

   $\frac{5}{6}, \frac{1}{2}, \frac{7}{12}, \frac{9}{10}$

7. Evaluate the following:

   $5\frac{1}{2} - \frac{2}{3} \times 3\frac{1}{4} + \frac{3}{8}$

8. Two-third of the members of the class lives in New town compound and of these $\frac{1}{2}$ live in location.

   (a) What fraction of the class lives in location?

   (b) If there are eight members of the class from New town, how many members are in class?

   (c) How many members of the class neither live in New town nor location?

THANK YOU FOR YOUR PARTICIPATION!