IMPROVING PERFORMANCE OF BASIC 2 PUPILS OF WESCO DEMONSTRATION BASIC SCHOOL IN ADDITION OF TWO-DIGIT NUMBER CONCEPT USING MULTI-BASE BLOCKS APPROACH

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***Abstract*: The study sought to improve the performance of basic 2 pupils of Wesco Demonstration Basic school in addition of two-digit numbers using multi-base blocks as an intervention strategy. An action research was design used for the study. A total sample size of 34 pupils; made up of 21 boys and 13 girls; with an average age of 8 years were used for the study. A purposive sampling procedure was used to select the pupils for the study. Test and interview were the two (2) instruments used for the study. Data were analysed using both qualitative and quantitative methods of data analysis. It was revealed that lack of parental support in school and at home; lack of TLMs; difficult language used by mathematics teachers when teaching; and lack of mathematics laboratories for practical lessons were some of the causes of pupils' difficulties in solving addition of two-digit number concept. Also, it was observed that pupils had seven (7) common misconceptions with regards to addition of two-digit number concept; and some of these misconceptions were that pupils add a column where it does not exist; and pupils sometimes begin adding with the left hand column first. Again, it was revealed that pupils' performance had improved greatly after they have been exposed to multi-base blocks approach. Finally, it was found out that all the pupils were very impressed about multi-base blocks approach used in teaching them the concept and that they wanted such activities to be continued in subsequent mathematics lessons. It was therefore recommended that Basic school teachers should use effective teaching approach such as multi-base blocks approach in teaching mathematical concepts such as addition of two-digit number concept so as to make mathematics teaching at the Basic school more practical to these young pupils in schools.**

***Keywords*: Improving, performance, basic 2, pupils, addition, two-digit number concept, multi-base blocks.**

I. INTRODUCTION

It is a well noted and accepted fact that development in almost all spheres of life, rests on effective knowledge of mathematics (National Council of Teachers of Mathematics, (NCTM), 2000). Boaler (2008) conceptualise mathematics as a human activity and a set of methods used to illuminate the world. This implies that the knowledge in mathematics can be used to illuminate all facets of human endeavour; and that one lives in darkness in the absence of mathematical knowledge.

The knowledge in mathematics is often applied or used in our day to day activities such as cooking, driving, savings and credit, buying and selling (Laure, 2008). Also, Akanni (2015) pointed out that mathematics as a field of symbolic representation of ideas, relations and an instrument for effecting a logical examination for the implementation of different ideas. Thus, mathematics enables an individual to develop logical thinking abilities to solve the numerous problems that surround him or her in the society.

Despite the importance of mathematics in everyday life, the poor performance of students (pupils) in mathematics at the Basic schools (i.e. primary and Junior high school) is of great concern to the school authorities, parents and other stakeholders in Ghana for some time now.

Available statistics and recent research findings in mathematics in Ghanaian Basic schools have shown abysmal performance among Basic school pupils in Trends in International Mathematics and Science Study (TIMSS); and Basic Education Certificate Examination (BECE) (Mereku & Anumel, 2011; Bosson-Amedenu, 2017; WAEC Chief Examiners Reports, 2018).

In a comparative study on Ghana's JHS 2 (grade 8) pupils' achievements in TIMSS in 2003 and 2007; Mereku and Anumel (2011) concluded that Ghana's JHS2 students' performance in mathematics, though improved significantly (i.e. from a scale score of 276 in 2003 to 309 in 2007), but Ghana still remains among the lowest in Africa and the world; with Ghana placed at 47th position on the overall mathematics achievement out of 48 participating countries.

In a study, Bosson-Amedenu (2017) posited that Ghana's Basic schools regularly fail to produce knowledgeable graduates, capable of pursuing further mathematics education due to declining academic performance in the BECE results. The WAEC Chief Examiners Reports (2018) also revealed that the BECE mathematics continues to yield poor results year after year since 1995.

This poor or abysmal performance of Ghanaian Basic school pupils in mathematics have been attributed to several factors; and one of these factors is the use of inappropriate teaching methods (often traditional lecture method) in teaching mathematics to these young pupils. Contributing to this debate, Achor and Kurumeh (2010: 68) stated categorically that "with such inappropriate methods, learners neither understood the basic principles, facts nor ideas behind the mathematical topics or concepts.

Addition of two-digit whole number concept is one of the essential mathematics topics in Ghanaian Basic schools syllabus for quite some time now; and it requires pupils to have better conceptual understanding of this concept. Studies by (NCTM, 2000;

National Assessment of Educational Progress (NAEP), 2001) have shown that the "addition of two-digit whole number concept" is very difficult for most Basic schools pupils to grasps especially those at the lower levels (i. e. Basic 1 to 3).

Studies by (Eze, 1983; NCTM, 2000; Chief Examiners of WAEC, 2005; Achor & Kurumeh, 2010) have recommended the use of effective and innovative teaching methods that involve manipulative, practical and child-centered activities capable of improving pupils' performance and also
arouse their interests in schools; and one of such strategies is the use multi-base blocks approach.

Multi-base blocks are instructional materials that can be used to teach various abstract mathematical concepts including number bases, place values, basic algebra, and arithmetic operations such as addition, subtraction, division and multiplication (NCTM, 2000; Achor & Kurumeh, 2010).

Diana and Hilbert (1988) posited that Diene's multi-base block approach is a practical, learner-centred, minds-on and hands-on innovative method of teaching especially difficult concepts in mathematics; and that it is a cognitive approach to meaningful mathematics instruction.

Since "addition of two-digit number concept" is difficult for Basic school pupils to understand; and that multi-base blocks approach could be used to develop pupils' conceptual understanding in this concept; then it is imperative to assist Basic school pupils to understand and improve their performance in this mathematical concept using multi-base blocks approach.

It is against this background, that this study was undertaken to help improve performance of basic 2 pupils of Wesco Demonstration Basic school in addition of two-digit number concept using multi-base blocks approach.

Statement of the Problem

The study of addition of two-digit number concept is a basic concept in mathematics, yet it is one of the difficult concepts in mathematics for Ghanaian Basic school pupils and that Basic 2 pupils of Wesco Demonstration Basic school cannot be exempted.

Through constant interaction with the teachers and pupils Wesco Demonstration Basic school; it was observed that most basic 2 pupils find it very difficult to answer simple questions in addition of two-digit number concept. Whenever they encounter any problem in this concept they become wanting. Only few pupils attempted some few questions in this concept and that most at times they got confuse and either lost along the line or stop entirely.

If these difficulties among these pupils are left untreated, then the country Ghana may soon lose great mathematicians like Archimedes, Einstein, etc. in a near future.

Studies by (Thompson, 1994; Obodo, 2004; Achor & Kurumeh, 2010; Kurumeh, Chiawa, & Ibrahim, 2010; Adu-Poku & Osei, 2020) have shown that Dienes' multi-base block approach could be used to improve learners' performance, interest and attitude in abstract mathematical concept including addition of two-digit number concept in schools.

It is in the light of this, that this study was carried out to improve the performance basic 2 pupils of Wesco Demonstration Basic school in addition of two-digit number concept using multi-base blocks approach.

Purpose of the Study

The purpose of the study is to improve the performance of basic 2 pupils of Wesco Demonstration Basic school in addition of two-digit number concept using multi-base blocks approach. Specifically, the study intends:

1) To find out causes of pupils' difficulties in solving addition of two-digit number concept.
2) To identify misconceptions held on by the pupils in addition of two-digit number concept.
3) To assess the effects of multi-base blocks approach in improving basic 2 pupils' performance in addition of two-digit number concept.

Research Questions

The study was guided by the following three (3) research questions.

1) What are the causes of pupils' difficulties in solving addition of two-digit number concept?
2) What are the misconceptions held on by the pupils in addition of two-digit number concept?
3) To what extent would the use of multi-base blocks approach help in improving basic 2 pupils' performance in addition of two-digit number concept?

Significance of the Study

The outcome of this study would be beneficial to the Ministry of Education, Ghana Education Service, mathematics teachers and other stakeholders in mathematics at the Basic education level.

The study would outline the possible causes of pupils' difficulties in solving addition of two-digit number concept. This would enable mathematics teachers to develop appropriate strategies to deal with such causes in pupils.

The study would also bring to light the various misconceptions held on by the pupils with regards to addition of two-digit number concept. This would enable mathematics teachers to further probe pupils' misconceptions before teaching this abstract concept.

The study would serve as a source of reference for those who wish to carryout similar study into issues on how to use multi-base blocks approach in solving pupils' difficulties in addition of two-digit number concept in Basic schools.

II. REVIEW OF RELATED LITERATURE

This chapter discusses the review of related literature that supports the study. The themes to be discussed in this aspect of the study are;

1) Causes of Pupils' Difficulties In Solving Addition of Two-Digit Number Concept.
2) Misconceptions Held On By Pupils In Addition of Two-Digit Number Concept.
3) Effects of Multi-Base Blocks in Improving Performance In Addition of Two-Digit Numbers.

Causes of Pupils' Difficulties In Solving Addition of Two-Digit Number Concept

Studies by (NCTM, 2000; Bol & Berry III, 2005; Fatola, 2005; Achor & Kurumeh, 2010; Okigbo & Okeke, 2011) have shown that there are several causes of pupils' difficulties or inabilities to solve addition of two-digit number concept.

Okonkwo (1997) stated that pupils' attitude towards mathematics is a major cause of pupils' difficulties in solving mathematical problems including addition of two-digit number concept. The study revealed that most pupils in basic schools have negative attitude towards mathematical concept. Thus, teachers should do well to help pupils to develop positive attitude towards mathematics.

Studies by (NCTM, 2000; Chief Examiners of WAEC, 2005) stated lack of instructional materials especially manipulatives and practical activities as the causes of pupils' difficulties. They recommended the use of effective instructional methodologies that involve manipulatives and representations in mathematics teaching and learning process.

Fatola (2005) indicated that pupils' poor interest as the cause of pupils' difficulties. The study concluded that students have a very low interest in mathematics; and that students hate or dislike abstract mathematical concept including addition of two-digit number concept.

Bol and Berry III (2005) also mentioned poor teachers' mathematical knowledge as the cause of pupils' difficulties in learning mathematics concept. Achor and Kurumeh (2010) also attributed causes of pupils' difficulties to inappropriate instructional methods used by teachers to present this concept to the learners. The study revealed that the use of traditional lecture method did not help pupils to understand the basic principles, facts or ideas behind this mathematical topic or concept.

Kurumeh et al (2010) stated that lack or inadequate use of teaching and learning materials (TLMs) and lack of mathematics laboratory were the major causes of the pupils' difficulty in basic schools. Okigbo and Okeke (2011) blamed teachers' incompetency and poor teaching methods used by teachers in teaching as the major causes of pupils' difficulties.

Misconceptions Held On By Pupils In Addition of Two-Digit Number Concept

Studies by (Sadi, 2007; Mathematics Navigator, 2013; Mathematics Mastery Toolkit, 2014) have indicated that school pupils have several misconceptions towards addition of two-digit number concept.

Sadi (2007) stated that the two (2) common misconceptions in addition of two-digit number concept are the pupils' inabilities to relate to the positioning of the numbers in the vertical presentation of addition and the process of carrying over into the next column; and these errors show lack of understanding of the place value concept in addition involving two-digit number concept.

Again, Mathematics Navigator (2013) also outlined some of the pupils' misconceptions on the addition involving two-digit number concept as;

1. Pupils' failure to recognize the structural basis for recording two-digit number (e.g.; reads 64 as sixty-four; but thinks of this as 60 and 4); and this is a serious misconception.
2. Pupils not able to determine how to add the ones together and tens together or does not use place value in adding the two-digit number concept.
3. Pupils may reverse the digits when they regroup.

On the other hand, Mathematics Mastery Toolkit (2014) reported three (3) common misconceptions that pupils encounter with regards to the addition of two-digit number concept as;

1. Pupils may add a column where it does not exist.
2. Pupils' failure to understand the place value of digit in the calculation.
3. Pupils' little sense of number beyond 10 (e.g. 14, is 10 and 4).

The above review of literature show that pupils' have misconceptions in addition of two-digit number concept; and that it is important that teachers should help pupils to overcome them in the teaching and learning process.

Effects of Multi-Base Blocks in Improving Performance In Addition of Two-Digit Numbers

Multi-base blocks which are also known as Dienes' base ten blocks or multi-base arithmetic blocks are mainly instructional materials that are used to teach mathematical concept.

The multi-base blocks were developed by a renowned Hungarian mathematician called Zoltan Paul Diene in the early 1960s, and propounded a six-part rationale for their usage (Diene, 1960). Diene designed multi-base blocks to clarify the teaching and learning of mathematical concepts including place values, basic algebra, and arithmetic operations such as addition, subtraction, division and multiplication.

According to Diana and Hilbert (1988) also cited in Kurumeh et al (2010), the Diene's multi-base block approach is a practical, learner-centred, minds-on and hands-on innovative method of teaching difficult mathematical concepts; and that it is a cognitive approach to meaningful mathematics instruction. In a study, Imoko and Agwagah (2006) also observed that the use new approach such as Diene's multi-base block approach arouses interests in students due to curiosity.

Studies by (Thompson, 1994; Obodo, 2004; Achor & Kurumeh, 2010; Adu-Poku & Osei, 2020) have shown that Dienes' multi-base block approach could be used to improve learners' performance, interests and attitudes in mathematical concepts including addition of two-digit numbers in schools.

In a study, Thompson (1994) found out that Dienes' block approach improved grade eight students' achievement significantly and interest in the mathematical concept taught them. In a similar study conducted using junior secondary students as sample, Obodo (2004) observed that the experimental classes which were taught with multi-base blocks instructional approach performed better than the control group in their post-test scores.

In another study, Achor and Kurumeh (2010) observed that students who were exposed to multi-base block approach performed better in their post-test scores than their control group counterparts. The study concluded that Dienes multi-base block approach is more effective in improving students' mean achievement score in this mathematical concept than the use of conventional method; and that the approach does not discriminate between male and female students rather it appears to guarantee a learning experience that will be beneficial to all the students.

In a recent study, Adu-Poku and Osei (2020) revealed that the students who were taught using multi-base block approach performed better in their post-test as compared to their pre-test scores in addition of two-& three-digit number concepts. The study concluded that this approach is effective in improving, enhancing and facilitating pupils' interest in addition of two-three digit numbers in schools.

This review of related literature indicates that multi-base blocks approach is very effective strategy that could be used to improve basic school pupils' performance in addition of two-digit number concept in schools; hence its usage in this study.

III. METHODOLOGY

Research Design

The design used for this study was an action research. The rationale for using this design was that the study sought to assist basic 2 pupils of Wesco Demonstration Basic school to improve their performance in solving addition of two-digit number concept using multi-base block approach as intervention strategy.

According to Anane and Anyanful (2016), an action research design has advantage by allowing a teacher to address problems that are closest to them in their local settings and bring changes in their classroom. Also, it allows teachers to try out different ways of doing things in the classroom/school setting until he/she finds something that really works for him/her and for the situation.

However, an action research design has weakness that it is more difficult to implement; because it consumes time and also it involves the use of both human as well as financial resources.

Sample and Sampling Procedure

The total sample size for the study was thirty-four (34) pupils; made up of 21 boys and 13 girls. The ages of these 34 pupils used for the study ranged between 7- 9 years; with an average age of 8 years.

A purposive sampling technique of the non-probability sampling procedure was used to select the pupils in an intact (whole) class for the study. This was because the all the pupils in the class had difficulties in solving simple questions in addition of two-digit number concept.

Instruments

Test and interview were the two (2) instruments used for the study. These instruments (test and interview items) have been described briefly below:

Description of the Test Item

Two (2) sets of tests called pre-test and post-test were constructed and used to collect data from the pupils. Each test (pre-test & post-test) contains ten (10) questions items on addition of two-digit number concept for 10 marks. The pre-test was used to assess pupils' performance before the start of the multi-base blocks intervention activities whiles the post-test was used to assess each pupil's performance after the implementation of the intervention activities. Samples of the pre-test and post-test could be found in Appendix A and B respectively.

Description of Interview Item

An interview guide called pupils' interview guide (PIG) was developed and used to collect data from the pupils during interview session of the study. The PIG had three (3) question items.

Question (1) sought data on causes of pupils' difficulties in solving addition of two-digit number concept; question (2) required data on the pupils' misconceptions with regards to the addition of two-digit number concept; whereas question (3) demanded data on effects of multi-base blocks approach in improving pupils' performance in solving addition of two-digit number concept.

Data Collection Procedure

Permission was first sought from the school authorities to carry out the study. Three (3) weeks were used for the data collection. Data collection was carried out in three (3) stages namely pre-intervention stage, intervention stage and post-intervention stage. These stages have been described below as follows;

Pre-Intervention Stage

In order to find out each pupil's performance before the start of the multi-base blocks approach, a pre-test was conducted in the class which lasted for 50 minutes. After the 50 minutes, the pre-test papers were collected, marked and scored. The test was done under relaxed supervision and conducive atmosphere for pupils to think meaningfully and answer the questions.

Intervention Stage

The intervention stage deals with teaching pupils the addition of two-digit number concept with multi-base blocks. Pupils were taught using various multi-base blocks to teach and learn the two-digit number concept in step-by-step through the following stages of activities.

Activity 1: Pupils were introduced to various multi-base blocks designed and used for the teaching as shown in Figure 1 below;

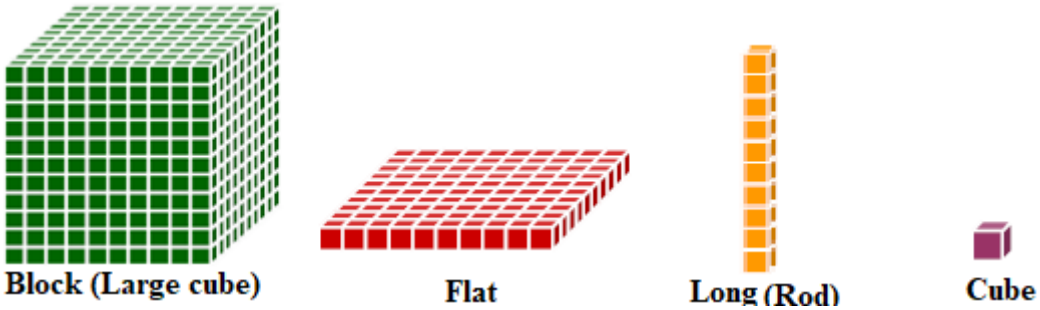

Figure 1: Types of multi-base blocks used in teaching addition concept

Activity 2: Pupils were guided to understand that multi-base blocks used consist of various blocks but the most common used blocks are called 'base ten block' and it consists of;

1. **Block (Large Cube)**:- is formed from 1000 cubes or 100 longs (rod) or 10 flats.
2. **Flats**:- is formed from 100 small cubes or 10 longs (rod).
3. **Long or rod**:- is formed from 10 cubes placed by end-to-end.
4. **Cube**:- is representing ones or units.

Activity 3: Pupils were made to understand that only long (rod) and cube could be used to learn the addition of two-digit number concept. During the lesson, pupils were guided to presents various values of numbers using the multi-base blocks such as 15, 18, 23, 38, 47 etc. For example, Figure 2 below depicts how to long (rod) and cube of the blocks to show 15 and 18 respectively to pupils.

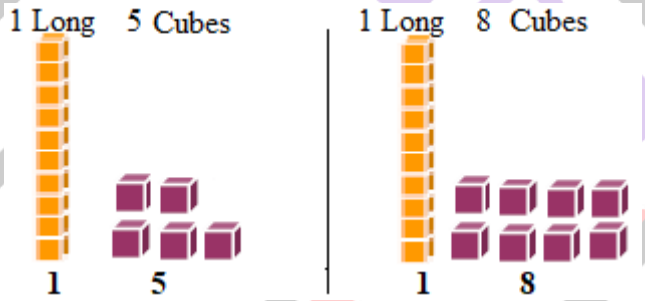

Figure 2: Illustration of 15 & 18 units with multi-base blocks respectively

Activity 4: Pupils were then taught how to regroup cubes (ones) into their respective tens and ones using multi-base blocks. For example, regroup 18 cubes become 1 long and 8 cubes and this is shown in Figure 3 below;

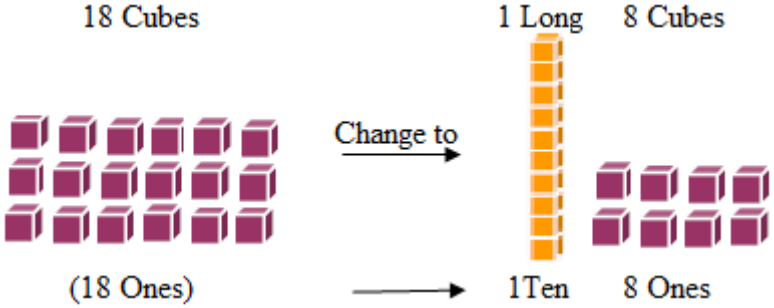

Figure 3: Changing 18 ones to 1 ten and 8 ones with multi-base blocks

Activity 5: Again, pupils were taught how to regroup or change 3 tens and 15 ones to 4 tens and 5 ones as equal to 45 as shown Figure 4 below;

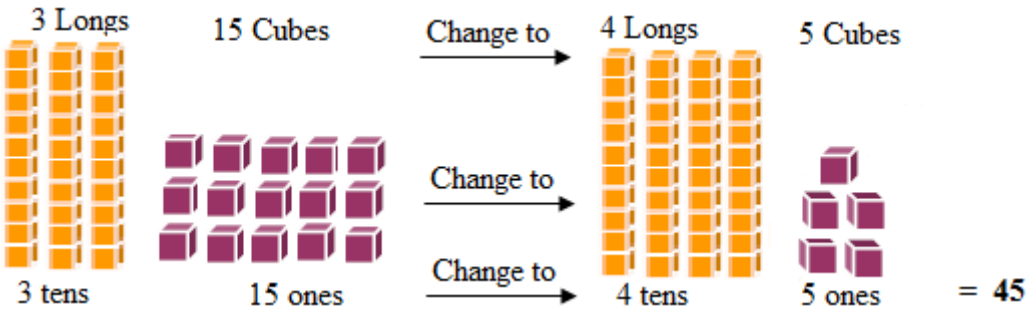

Figure 4: Changing 3 tens & 15 ones to 4 tens and 5 ones as 45

Activity 6: Pupils were guided in groups and as individuals to manipulate the multi-base blocks to solve several additions of two-digit number concept questions. For example 1 8 + 1 5 = 33 was solved with multi-base blocks as shown in Figure 5 below:

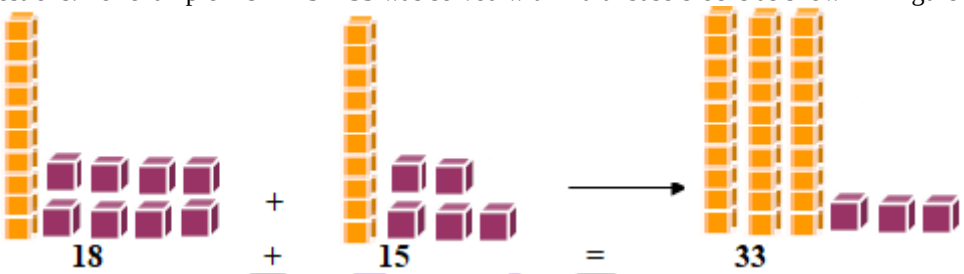

Figure 5: Illustration of (18 + 15 = 33) using multi-base blocks

Activity 7: Several examples (such as examples 1 & 2), were given to pupils and they were guided to solve them using the multi-base blocks as shown in Figures 6 and 7 respectively below:

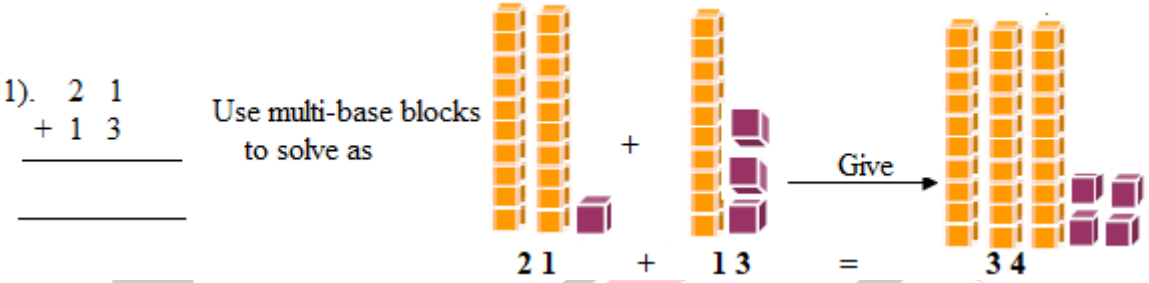

Figure 6: Illustration of (21 + 13 = 34) using multi-base blocks.

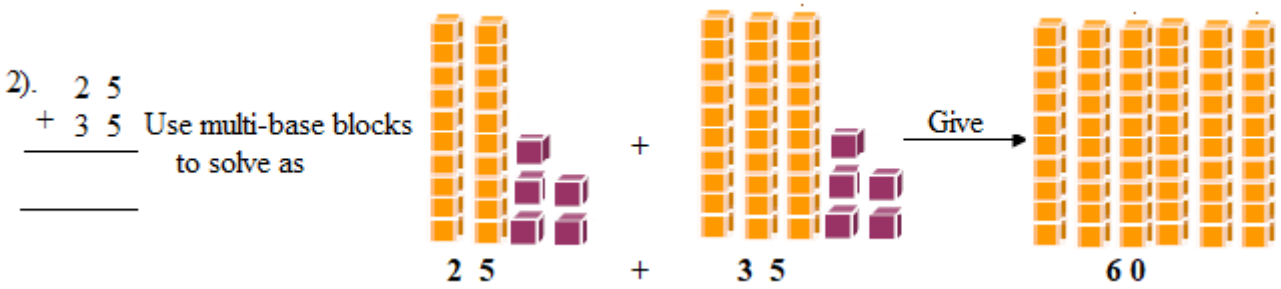

Figure 7: Illustration of (25 + 35 = 60) using multi-base blocks.

Conclusion:- This step-by-step hands-on and mind-on practical approach helped pupils to understand the addition of two-digit number concept easily. Pupils were then given several exercises and assignments on the concept taught to solve; and almost all the pupils did very well in all the exercises/assignment given.

Post-Intervention Stage

After the implementation of the multi-base blocks approach intervention activities; 50 minutes post-test was conducted for all the pupils. The post-test was done to determine each pupil's performance after the implementation of the multi-base blocks approach intervention activities.

After the conduction of the post-test, one-and-one interactive interview session was conducted for all the pupils in their classroom using the pupils' interview guide (PIG). Interview session for each pupil lasted for 5 - 10 minutes.

Data Analysis Method

The study employed both quantitative and qualitative methods of data analysis. Data from the test (pre-test & post-test) were analysed quantitatively using descriptive statistics namely frequency and percentage. On the other hand, data from the PIG were also analysed qualitatively and used to answer the research questions that guided the study.

Statistical Package for Social Science (SPSS) version 18.0 for window was used for data analysis and Microsoft excel program was used to present the data into tables and bar-chart.

IV. RESULTS AND DISCUSSION

Analysis of the Results

Tests (pre-test & post-test) and pupils' interview guide (PIG) were the two (2) instruments used to collect data from 34 pupils in basic 2 of Wesco Demonstration Basic school. Ten (10) question items pre-test and post-test were used to collect data from the pupils. Each test was scored 10 marks (i.e. 1 mark for each correct answer). Data from the tests (pre-test & post-test) were analysed quantitatively using frequency and percentage. Data from the tests were used to answer research questions 2 & 3 only.

On the other hand, data from the PIG were also analysed qualitatively; and were used to answer research questions 1, 2 & 3 respectively. These analyses were used to answer the three (3) research questions that guided study as follows.

Presentation of Results by Research Questions

Research Question 1: What are the causes of pupils' difficulties in solving addition of two-digit number concept?

In answering research question 1, pupils' answers to question (1) in the pupils' interview guide (PIG) on the causes of pupils' difficulties in solving addition of two-digit number concept were analysed and are presented in Table 1 below.

Table 1: Causes of Pupils' Difficulties in Addition of Two-Digit Numbers

No	Cause of pupils' inability to perform in addition of two-digits numbers
1	Lack of parental support in school and at home.
2	Lack of teaching and learning materials (TLMs).
3	Lack of practical or activity-oriented lessons.
4	Pupils' fear of mathematics teachers.
5	Pupils' fear of mathematics as a difficult subject.
6	Lack of pupils' interest in mathematics as a subject.
7	Pupils' poor attitudes towards mathematics.
8	Lack of required mathematics textbooks.
9	Difficult language used by mathematics teachers when teaching.
10	Abusive language used by mathematics teachers when teaching.
11	Lack of mathematics laboratories for practical lessons.

Sources: (Pupils' Interview Guide, 2021)

Data in Table 1 above shows that there are several causes of pupils' difficulties in solving addition of two-digit number concept in the school. Some of the causes of pupils' difficulties in solving addition of two-digit number concept identified include lack of parental support in school and at home; lack of teaching and learning materials (TLMs); lack of practical or activity-oriented lessons; pupils' fear of mathematics as a difficult subject; pupils' poor attitudes towards mathematics; lack of required mathematics textbooks; difficult language used by teachers when teaching; abusive language used by mathematics teachers when teaching; and lack of mathematics laboratories for practical lessons.

Data in Table 1 above show that there are several causes of pupils' difficulties in solving addition involving two-digit number concepts in the school.

Research Question 2: What are the misconceptions held on by the pupils in addition of two-digit number concept?

In answering research question 2, pupils' answers to question (2) in the PIG were analysed. In addition, pupils' mistakes/errors made in the tests were identified and presented as misconceptions. Some misconceptions identified in the PIG and the tests were analysed and are presented in Table 2 below:

Table 2: Pupils Misconceptions on Addition of Two-Digit Number Concept

No	Pupils' misconceptions in addition of two-digit number concept
1).	Pupils add a column where it does not exist. **For 27 + 18 = ☐ they may write:** 2 7 + 1 8 3 1 5
2).	Pupils' failure to understand the place value of the digits in the calculation.

	For 24 + 33 = ☐ they may write as: $\begin{array}{r} 2\ 4 \\ +\ 3\ 3 \\ \hline 3\ 2\ 7 \end{array}$
3).	Pupils are sometimes confused that addition is associative.
4).	Pupils to consider each digit in column addition as a separate number rather than as a representation of the number of tens or ones.
5).	Pupils' had little or no sense of numbers beyond 10 (e.g., 14 is 10 and 4).
6).	As pupils move into working with 3-digit numbers, they may not understand that the hundreds column exists when the numbers in the original calculation (the 2-digit numbers) do not contain any hundreds. For 58 + 71 = ☐; they may write :- $\begin{array}{r} 5\ 8 \\ +\ 7\ 1 \\ \hline 2\ 9 \end{array}$
7).	Pupils sometimes begin adding with the left hand column first.

Source (Pupils' Tests Papers & Interview Guide, 2021).

Data in Table 2 above indicates that pupils in this study have several misconceptions with regards to addition of two-digit number concept. From Table 2 above, seven (7) misconceptions were identified among basic 2 pupils in this study.

Some of the identified misconceptions are that:- pupils add a column where it does not exist; pupils' failure to understand the place value of the digits in the calculation; pupils are sometimes confused that addition is associative; pupils' had little or no sense of numbers beyond 10; pupils find it difficult to add when a zero is involved and that they might not record a zero in an answer; and pupils sometimes begin adding with the left hand column first.

The responses made by these pupils in Table 2 above show that basic 2 pupils in this study possessed varied misconceptions with regards to addition of two-digit number concept.

Research Question 3: To what extent would the use of multi-base blocks help in improving basic 2 pupils' performance in addition of two-digit number concept?

In answering research question 3, all the 34 pupils scores in both pre-test and post-test were analysed quantitatively (using frequency and percentage); compared and are presented in Table 3 below;

Table 3: Comparing of Pupils Pre-Test and Post-Test Scores

Pre-Test Scores			Post-Test Scores		
Marks (x)	Frequency	Percentage	Marks (x)	Frequency	Percentage
0	4	11.8	0	0	0.0
1	12	35.4	1	0	0.0
2	7	20.6	2	0	0.0
3	4	11.8	3	1	2.9
4	3	8.8	4	2	5.9
5	1	2.9	5	2	5.9
6	1	2.9	6	4	11.8
7	1	2.9	7	5	14.7
8	0	0.0	8	7	20.6
9	1	2.9	9	5	14.7
10	0	0.0	10	8	23.5
Total	**34**	**100**	**Total**	**34**	**100**

Source: (Pupils' Marked Pre-test & Post-test Script, 2021)

Data in Table 3 shows that only 4 pupils representing 11.8% passed the pre-test whereas as many as 30 pupils representing 88.2% failed the pre-test by having scores less than 5 marks.

On the other hand, as many as 31 pupils representing 91.2% passed the post-test by having scores above 5 marks; whereas only 3 pupils representing 8.8% failed the same post-test. This statistics indicates that pupils performed better in the post-test than in the pre-test scores.

The results in Table 3 have been presented pictorially in a bar-chart as shown in Figure 8 below:

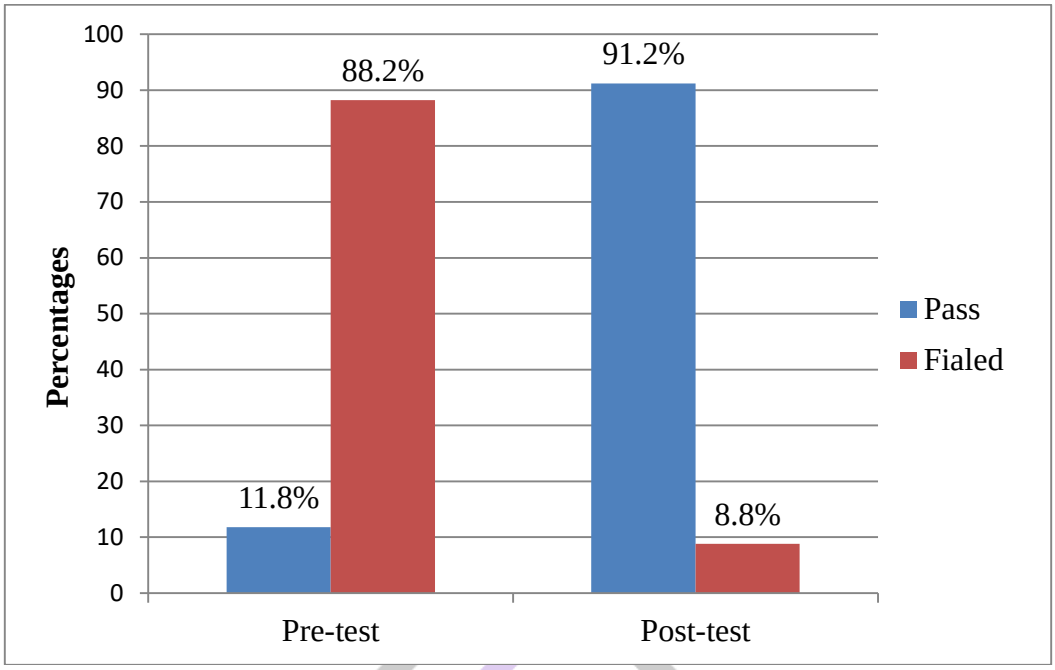

Figure 8: Comparing pupils' pre-test and post-test scores in percentage

In comparing the pre-test and post-test scores from Figure 8 above, it shows that pupils' performance had greatly improved in the post-test than that of the pre-test. This great improvement might be attributed to multi-base blocks approach implemented in improving pupils' performance in the addition of two-digit number concept.

Again, pupils' responses to question item (3) in the pupils' interview guide (PIG) during the interview session were that almost all the pupils indicated that they liked the way the multi-base blocks approach were used to teach addition of two-digit number concept to them. They unanimously agreed that innovative and effective instructional method such as multi-base blocks approach should be used to teach them other abstract mathematics concepts.

Discussion of the Results

The results of this present study showed that there were several causes of pupils' difficulties in solving addition of two-digit number concept. Some of the causes of pupils' difficulties identified in this study include lack of parental support in school and at home; lack of TLMs; pupils' fear of mathematics as a difficult subject; lack of required mathematics textbooks; difficult language used by mathematics teachers when teaching; abusive language used by mathematics teachers when teaching; and lack of mathematics laboratories for practical lessons. This result showed that there were several causes of pupils' difficulties in solving addition of two-digit number concept. This finding is in agreement with the result of (NCTM, 2000; Bol & Berry III, 2005; Fatola, 2005; Achor & Kurumeh, 2010; Okigbo & Okeke, 2011) that there are several causes of pupils' difficulties to solve addition of two-digit number concept.

The study identified seven (7) common misconceptions among the pupils who took part in this study. Some of the identified misconceptions were that:- pupils add a column where it does not exist; pupils' failure to understand the place value of the digits in the calculation; pupils were sometimes confused that addition is associative; pupils' had little or no sense of numbers beyond 10; pupils find it difficult to add when a zero is involved and that they might not record a zero in an answer; and pupils sometimes begin adding with the left hand column first. This result showed that pupils had several misconceptions on addition of two-digit numbers. This finding is in support of the result of (Sadi, 2007; Mathematics Navigator, 2013; Mathematics Mastery Toolkit, 2014) that school pupils have several misconceptions towards addition of two-digit number concept.

It was observed that basic 2 pupils' performance had improved greatly in the post-test scores than the pre-test scores. This better improvement might be attributed to the multi-base blocks approach implemented in the class. This finding is in support with the results of (Thompson, 1994; Obodo, 2004; Achor & Kurumeh, 2010; Adu-Poku & Osei, 2020) that Dienes' multi-base block approach could be used to improve learners' performance, interests and attitudes in mathematical concepts including addition of two-digit numbers in schools.

Finally, it was revealed that pupils were very impressed about multi-base approach implemented in the class and that it was more practical and hands-on activities; and they wanted more of such approach to be continued in their mathematics lessons. This finding is in agreement with the results of Diana and Hilbert (1988) that Diene's multi-base block approach is a practical, learner-centred, minds-on and hands-on innovative method of teaching difficult mathematical concepts.

IV. CONCLUSIONS

It can be concluded that lack of parental support in school and at home; lack of TLMs; lack of required mathematics textbooks; and lack of mathematics laboratories for practical lessons were some of the causes of pupils' difficulties in solving addition of two-digit number concept. Again, it can be concluded that basic 2 pupils had several misconceptions in addition of two-

digit number concept. It was observed that pupils' performance had improved greatly after they have been exposed to multi-base blocks approach. Finally, it can be concluded that multi-base blocks approach was very effective in improving pupils' conceptual understanding (performance), interest as well as attitudes in addition of two-digit number concept.

Recommendations

Based on the findings and conclusions drawn, it was recommended that:

1) Basic school teachers should use effective teaching approach such as multi-base blocks approach in teaching mathematical concepts such as addition of two-digit number concept so as to make mathematics teaching at the Basic school more practical to these young pupils in schools.
2) Government of Ghana and other stakeholders in SHS education should build well equipped mathematics laboratories/practical rooms in all SHS in the country so that Basic school pupils can learn mathematics in more practical manner instead theoretical approach being used in schools.

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