UNIVERSITY FOR DEVELOPMENT STUDIES

TRAINING TEACHERS ON THE USE OF DIENES MULTI-BASED BLOCKS TO TEACH BASIC SIX PUPILS PLACE VALUE AT NABULUGU D/A PRIMARY SCHOOL IN WEST MAMPRUSI DISTRICT.

YAMUSAH TAHIDU

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FACULTY OF EDUCATION – TAMALE

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BY

YAMUSAH TAHIDU (B.ED Basic Education)

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DISSERTATION SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL FOUNDATION STUDIES, FACULTY OF EDUCATION, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE AWARD OF A MASTER OF EDUCATION DEGREE IN TRAINING AND DEVELOPMENT

NOVEMBER, 2018

DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this University.

Candidate's Signature…….. Date:…….

Name: Yamusah Tahidu

Supervisor's Declaration

I hereby declare that the preparation and presentation of the project dissertation was supervised in accordance with the guidelines on supervision of dissertation laid down by the University for Development Studies (UDS)

Supervisor's Signature…….. Date:…….

Name: Dr. Anthony Kudjo Donkor

ABSTRACT

The researcher observed that most teachers do not teach with appropriate teaching and learning materials especially during Mathematics lessons. They undermine the value of Dienes Multi-Base resources and therefore, do not even take into consideration the type of TLMs to be used when planning their lessons. It is as a result of the above mentioned menace that has necessitated embarking on this research. The qualitative research design was adopted by the researcher for this study. The research instruments employed for the study were observation and interview. Findings from the interview revealed that most teachers do not use Dienes multi-based block resources in their mathematics lesson delivery and even the few that teach place value in math's lesson are not using Dienes multi-based block resources. The interview also revealed that most teachers lack the spirit of using self-made materials (locally available materials) to support the few sophisticated materials available for teaching and learning. Findings from the observation confirmed that some teachers actually teach using chalkboard illustrations and pictures from pupil's text books. Others teach using the lecture method which affects children understanding of concepts and ideas. After intervention, it was recommended that the Ghana education service (GES) should enforce by-laws to guide the implementation of school- based (SBI) and cluster-based in-service (CBI) training in our schools. Supervision unit of the GES should be strengthened up by circuit supervisors to do proper monitoring and supervision. Colleges of Education should infuse DMBs materials preparation and usage as a course in order to equip teachers with the skills of developing interactive materials for teaching and learning in schools, especially the basic school level. The districts training officers should organise training based on the needs of the trainees not on huge funds to maximise profit. Guidelines for organising appropriate refresher for teachers in mathematics should be strictly followed.

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DEDICATION

This dissertation is dedicated to my parents, my wives and my children.

TABLE OF CONTENT

CHAPTER ONE

OVERVIEW

This chapter is made up of sections include, the background to the study, statement of the problem, objectives of the study, purpose of the study, research questions and hypotheses, significance of the study, scope of the study, the structure of the study and conclusion.

1.1 BACKGROUND TO THE STUDY

Education is the backbone of every nation. It is necessary for the development of every organization in this world. Education enhances both human and materials resources. Mathematics plays a vital role in education, such as, every single human activity in our homes, schools, work places, market places, and many more. Many parents or guardians are extremely concerned about the academic performance of their wards just because they consider education as an investment in human resources and learning process. As a logical body of knowledge, mathematics can be used as a guide for arriving at results in a systematic way. It is a way of thinking not only working but also the way the individual plans his activities.

Dienes multi-based block (DMB) materials is a practical, learner-centered, mind –on and hands – on innovative method of teaching special or difficult concepts like place value in mathematics. It is a cognitive to meaning meaningful mathematics instruction (Diana & Hilbert, 1988). This was invented by a 20th Century renowned Hungarian mathematician called Zoltan Paul Dienes. He devised this material to demystify the learning of mathematical concepts among the youths. Dienes' Block consists of a block of 1000 unit cubes. This block comprises of a unit long, flat,

(square), block and a group of blocks as the case may be. A unit is a cube of 2*2*2 cm3 in dimension. A long (line) contains ten cubes, flat contains hundreds of cubes and block contains one thousand of cubes.

Dienes' block is applied using base (ten) 10 but can be easily decomposed into other bases. The relationship between unit-line-square- block is based on the idea of place value and its significance. This block is used in solving problems involving conversion and mathematical operations of plus, minus, multiplication, division and place value practically.

The high rate of poor academic performance in mathematics of Nabulugu D/A primary basic six pupils is a concern to whole community which needs urgent and appropriate attention to eradicate this phenomenon. It is due to the failure of some teachers to use appropriate and standard teaching and learning materials (TLMs) during instructional hours. It is necessary for teachers to acquire the appropriate skills of handling and manipulating TLMs especially Dienes multi -based resources in teaching mathematics.

According to Adjei (2013) teaching learning resources is a generic term used to describe the resources teachers use to deliver instructions. When learners interact with materials, learning becomes permanent. As teaching and learning influenced the impact of knowledge and skills to learners, Denies resources for training teachers are very necessary in teaching. DMB resources form a significant part of lesson delivery most especially, at the basic school level. It is believed that using multi-based resources in teaching will help improve upon the academic performance of the pupils especially in mathematics.

It is therefore, important to note that Denies multi-based resources play a very significant role for the learners to understand the concepts of place value and helps reduce the waist of instructional

time in the classroom. Many parents assess the quality of the educational system conventionally by analyzing the results of the products of the system over the years. The poor performance of the pupils or students in Basic Education Certificate Examinations (BECE) and the Senior Secondary School Certificate Examinations (SSSCE) respectively give parents or guardians cause to complain with a view to identify and rectify lapses in the academic ladder.

This will help to develop children's skills, knowledge and attitudes that will prepare them adequately to apply real life situation in future. In the course of my stay at the school as a head teacher, I have observed that most teachers teach without using appropriate teaching and learning resources especially newly recruited teachers. This usually makes learners almost all the time learn through rote. As newly recruited teachers, some may face challenges like types of teaching learning resources, in mathematics which included multi- based materials usage in specific areas like place value. Some fresh teachers undermine the significant role of teaching learning resources. It is as results of the above mentioned prompt me to undertake this research topic to contribute my quota to help newly recruited teachers to develop the interest of using teaching resources during mathematics lesson delivery.

According to University College of Cork (2003), flexibility in teaching resources and the use of multimedia make it possible to reach out total learning styles. Blackboard or multimedia and course web site can provide the syllabus, assignment, discussion group, individual task, project work, video materials and power point presentation. It is time to note that teaching and learning resources play important role so far as teaching and learning is concern. As newly recruited teachers there is the need for them to interact with these materials to accord their classroom practice in place value lesson. It is important to note that, no country can advance without a sound scientific base and mathematics forms the root of science.

There is the need to design and adopt strategies that will make the teaching and learning of mathematics, especially the basic operations, interesting at the basic school level of education in Ghana. The researcher is interested in training newly recruited teachers on the use of multi-based block to teach place value.

1.2 PERCEIVED PROBLEM

In the course of the researchers stay at the district as a teacher, the researcher noticed that most teachers did not teach with appropriate teaching and materials. Children rather are engaged in rote learning. The researcher got to realize this unfortunate incident when he was appointed as the head teacher in the school. The major role of head teachers is to support teachers who have challenges in handling specific subject areas. Some teachers undermine the value of DMBs resources and therefore, do not even take into consideration the type of TLMs to be used when planning their lessons. It is as a result of the above mentioned menace that has necessitated embarking on this research to contribute my quota to help teachers and pupils in the district to be fully aware of the need to always use materials which are relevant to support teaching and learning in the classroom. This will help to build teachers professional growth and development and that can translate positively in students' performance.

1.3 PROBLEM DIAGNOSIS

Play has been identified as one of the key contexts for children's early growth and development (French, 2007). When children interact with materials, learning becomes permanent. This will help to develop children knowledge, skills and attitudes that will prepare them adequately to face the realities of life when they become adults in future.

1.4 EVIDENCE

1.4.1 In-formal observation: Observation showed that some mathematics teachers in the school teach place value without using multi-based blocks materials which is worrying.

1.4.2. Interview: A few of the pupils are willing to pursue mathematics after the Basic Education Certificate Examination and also few teachers make mathematics interested for learners.

1.4.3. Quizzes and class exercises revealed that only less than half of the pupils get the average mark in mathematics at the upper primary.

1.4.4. Results of Entrance exams and cumulative records for primary six pupils who are transiting to the Junior High School in 2016 brought to light that less than half of students score the average mark in mathematics.

1.5. CAUSES OF THE PROBLEM

1.5.1. Observation

- Inadequate skills of some newly recruited teachers to use multi-based blocks to teach place value appropriately at the basic schools was revealed.
- Teachers who are not trained as mathematics teachers assumed to be teaching the subject.
- Some teachers did not always prepare adequately before going to the classroom.

1.5.2. Interview:

- Teaching and learning materials were expensive to acquire.

- Many people perceived mathematics to be a very difficult subject or course to pursue. Hence, the teaching of mathematics is affected.
- Lack of interest by people to take up mathematics courses from the Primary to the university level was evidence.
- Developing the capacity of mathematics teachers to make them competent in the school was lacking. Our continued existence depends on the mastery of the knowledge and attitudes of mathematics and technology. In view of this, a country like Ghana needs mathematicians literate citizens who can make informed choices in their personal lives and approach challenges in the workplace in a systematic and logical order.
- They also need to become competent professionals in the various mathematician disciplines who can carry out research and development at the highest level. Therefore, the general aims for mathematics education at the basic level are meant to help pupils to:

  i. Develop understanding of mathematics concepts and principles.

  ii. Develop an appreciation for the application of science to life.

  iii. Think and act mathematical and

  iv. Develop logical attitudes towards life.

In order to realize the above goals, Ghana has sought to increase and sustain interests in mathematician and technology and in mathematicians related programmers at the basic, secondary and tertiary levels of education. Aina (2011) has the view that primary education is the bedrock of educational continuum and it requires a solid foundation in mathematics. The researcher made a visit to the schools to find out how teachers deliver lessons in mathematics, the observation of the researcher showed points such as:

- Inadequate instructional materials for teaching mathematics at the basic level.
- School heads confirmed decline in the performance of students in mathematics over the past years especially with reference to BECE results. They added that, this is as a result of students lacking interest in the mathematics subject.
- Some teachers stated that the imported instructional materials are based on foreign concepts which make it difficult for some children to relate that concept into their immediate classroom situation.
- Some pupils also confirmed that hardly do their teachers use mathematics TLMs (DMBs resources) in the mathematics classroom.

1.6. STATEMENT OF PROBLEM

Teaching resources are the only materials that can be used as components in effective lesson delivery in learning centers. Under the mission of Ghana Education service, teaching and learning materials form one of the key components of instructional resources that will make lesson interesting and lovely. Concrete teaching resources like DMBs will enhance students understanding of concepts so that they will be able to apply the knowledge acquired in the real life situation. However, most teachers teach without these learning resources.

This problem has contributed greatly to the poor performance of students in mathematics in the nation as a whole. It is common to see even existing teachers teaching for a whole term without using even a single teaching and learning aid and this inhabit student's productivity and academic achievement. In response to this problem, the study is to investigate into the problem to make teachers realize the need to always use DMBs materials during mathematics lesson.

This will eventually improve performance at all levels. The study will inculcate in new teachers

the habit of preparing adequate teaching and learning materials to achieve maximum results at the end through organizing a series of training for newly recruited teachers to acquire skills and update their knowledge.

Research evidence by the World Bank supports the view that considerable contribution are made by text books and other instructional resources to effective teaching and improve the quality of education (Farrel and Heyneman, 1989). The view in current national education document is that learning materials are integral part of curriculum development learning support materials for OBE (1998).All the above made the researcher to write on this topic to create awareness of the value of multi-based resources.

Greenwald, Hedges and Lain (1996) stated that, the more teaching experience the teacher has, the higher the probability of increase in students' achievement. There is therefore the need to identify the problem areas in learning mathematics so that efforts would be made to resolve the problems of place value.

1.7. PURPOSE OF THE STUDY

The main purpose of the research is to train newly recruited teachers on the use of multi- based blocks to teach basic six pupils place value in mathematics at Nabulugu D/A primary school in the West Mamprusi District.

1.8. OBJECTIVE OF THE STUDY

The objectives that guided this study are presented below:

1.8.1 Main Objective

The main objective of the study was to train teachers on the use of DMBs materials to teach

basic six pupils place value at Nabulugu D/A Primary School.

1.8.8 Specific Objectives of the study

1. To examine the uses of DMBs materials in basic six mathematics.

2. To train teachers on the use of DMBs materials to teach place value.

3. To examine the effects of not using Dienes multi-based materials to teach place value.

4. To ascertain the effective use of DMBs resources to teach basic six pupils place value.

1.9. RESEARCH QUESTIONS

1. What are DMBs teaching resources in mathematics?

2. What are the effects of using DMBs materials in teaching place value?

3. What is the impact of DMBs materials on pupils' performance?

4. What method can be used to train teachers on the use of DMBs Materials to teach place value?

1.10. SIGNIFICANCE OF THE STUDY

The purpose of this study is to train teachers on the use of DMBs materials to acquire skills and knowledge on how to deliver lessons with the use of these materials to improve classroom practices. It is real that some teachers prefer the use of lecture method to practical method of teaching. Many efforts have been made in the corporate countries including Ghana to make teaching flexible for economic importance and national development. In this sense, teachers need to teach all subjects in schools by adopting the use of appropriate relevant resources to arose and sustain the interest of learners during instructional hours.

The final findings of this research will go a long way to provide adequate information for further research in a related study. The problem of poor performance of mathematics students in Nabulugu may be similar, if not the same to students of other schools. Hence may provide a basis for research as related to other topics in mathematics.

The findings of this study will suggest to the Ministry of Education and Ghana Education Service (GES) to organize numerous training for teachers on the use of teaching and learning materials (TLMs) especially DMBs resources to teach in schools.

The study will help the curriculum planners and research development directorate (CRDD), the Ghana Education Service (GES) and Ministry of Education (MoE) in their work to restructure certain aspect of the mathematics to use specific TLMs with certain topics.

1.11 SCOPE OF THE STUDY

This study will only focus on the training of teachers on the use of Dienes Multi-Based Blocks to teach basic six pupils place value at Nabulugu D/A Primary School in West Mamprusi District.

1.12 ORGANISATION OF THE STUDY

This study will be structured in the following: chapter one will present and discuss the background of the study, statement of the problem, objectives of the study, the research questions, significance of the study, scope of the study and organization of the study. Chapter two will present the literature review. Chapter three will present the methodology. Chapter four will present the results and discussions, chapter five will present the summary, conclusion and recommendations of the study.

1.13 CONCLUSION

This chapter has presented and discussed each of the following: the background to the study, statement of the problem, objectives of the study, purpose of the study, research questions and significance of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

The aim of this chapter is to review existing literature on how to use Dienes Multi-Based Blocks to train teachers on how to teach pupils place value. The review will include: the cconcept of mathematics education, the concept of training in mathematics, the concept of Dienes Multi-Based Block Resources, the concept of place value, the Hindu-Arabic Numeration System, the theoretical framework, the concepts of Teacher Learner Resources and conclusion.

2.1 CONCEPTUAL ANALYSIS

The conceptual analysis takes a critical look at mathematics education, refresher training, and concepts of Dienes multi-base block resources and place value. This study is backed by the theory of learning and intellectual development of children. The researcher will consider this theory as a means to help teachers to develop interest and prepare appropriate lessons to deliver using Dienes multi-based blocks resources at Nabulugu D/A Primary School. The concepts reviewed are:

2.1.1 Concept of Mathematics Education

Mathematics is a fundamental branch of science that represents the study of basic concepts of numbers, space and quality as well as application of these concepts in the field of physics and engineering. According to Crockcroft (1991), Mathematics is to develop the skills of mental and written computation found on the basic concepts, which need to be developed through the use of structural apparatus and many other activities. Some basic concepts include meaning of the

operation, addition and subtraction is very important when it comes to place value.

According to United Nation Education, Mathematics and Cultural Organisation (2010), Mathematics development in recent decades has, and will continue to have a significant influence on topics that have great importance for humanity, quality of life, the sustainable development of the planet, and peaceful coexistence amongst people. From the immediate basic essentials of life such as access to water, food, shelter, management of agricultural production, water resources, health, energy resources, biodiversity, the environment, transport, communication among others all have a strong mathematics component to which everybody should have access to take part in local, regional, national and transnational decisions in a meaningful way.

Mathematics must not only respond to the needs of society in order to improve the quality of life of the minority population but to address needs of humanity in general. UW-Stout (2010), has the view that teaching follows the following ways: instruction, evaluation, student-academic advisement, academic program planning, and curriculum development.

Instruction is the imparting of knowledge, developing of skills and attitudes, and meeting of special needs in various ways ranging from structured to individualized activities, including instructional support activities which aid and enrich the teaching-learning process. Evaluation is vital to the instruction process and is a basis for academic program planning and student advising.

IGI Global. (2017) explains teaching in the following ways: The activities involved in facilitate or educate to impart knowledge or skills to learners. Hence, to teach means to do the work of teaching practically. In education, teaching is the concerted sharing of knowledge and experience, which is usually organized within a discipline and, more generally, the provision of stimulus to the psychological and intellectual growth of a person by another person or a group of persons.

Pre-planned behaviours informed by learning principles and child development theory which directs and guides instruction to ensure desired students outcomes.

Teaching is an instruction or delivering a particular skill or subject or something that someone tells you to do. For teaching in this case, may refer to showing or explaining to a student how to do something. Teaching is considered as deliberate actions undertaken with the intention of facilitating learning. Teaching is an activity aimed to meaningful learning through a method that is morally and pedagogically acceptable. It involves a teacher, a learner, and content in the form of knowledge, facts, information and skill to be imparted. Teaching is deliberate intention on the part of the learners to learn, and finally a method that respects the learner's cognitive integrity and freedom of choice.

IGI Global (2017), therefore, has the view that, there are two fundamentally different ways of understanding teaching. The first sees teaching as an instructor-centered activity in which knowledge is transmitted from someone who has acquired that knowledge to novice learners teaching as knowledge transmission.

The second sees teaching as a learner-centered activity in which the instructor ensures that learning is made possible for learners to be given support, guide, and encourage them in their active and independent creation of new knowledge, to impart knowledge or skill give instruction, inform, enlighten, discipline, drill, indoctrinate, coach to help to learn. It involves the interaction of three elements: the teacher, student and the object of knowledge.

Thomas (2007), summarizes by saying that district and teacher leadership teams must work together to accurately assess their current teaching models and investigate new models that will address current issues and challenges. Including the new "learning team" mentality in which the

entire school team works to deliver better academic performance. Cohesive, comprehensive and integrated human resource, instructional, and professional development strategies are the driving force and technology tools and infrastructure are a core part of the foundation.

2. 1. 2 Concept of Training in Mathematics

Human resource is very important as it is the backbone of every organisation. Institutions and organizations invest huge amount on the human resource capital because the performance of human resource will ultimately increase the performance of institutions and organizations. Performance is a major multidimensional construct aimed to achieve results and has a strong link to strategic goals of an organization (Mwita, 2000).

Teachers throughout the world are experiencing an unprecedented transition in their role and status and demands on them are becoming increasingly multifaceted. Many teachers do not have the training or experience to cope with this changing role (European Commission, 2000).

Training has been defined as the systematic development of the knowledge, skills and attitudes required by an individual to perform adequately a given task or job. Training is planned process to modify attitude, knowledge or skill behaviour through learning experience to achieve effective performance in an activity or range of activities. Its purpose in the work situation is to develop the abilities of the individual and to satisfy current and future manpower needs of the organisation. It clearly implies that the role of training is to improve the overall performance of institutions and organisations. The term 'performance' is, therefore, interwoven with training (Manpower Services Commission, 2000).

Refresher training is defined as a workshop for employed professionals, paraprofessionals and other practitioners to acquire new knowledge, better methods, etc. to improve their skills toward

more effective, efficient and competent rendering of service in various fields and to diverse groups of people. Refresher training for teachers on the use Dienes multi based resources to teach basic sex pupils place value, such that workshop will design to benefit a specific group of teachers at a particular school. Refresher training will improve the quality of teachers for the development of their profession.

Refresher training will help Professional non-professional teachers to acquire skills and knowledge for both personal development and career advancement. Refresher training will help to develop all types of employee occupation with opportunities situated in practice. It has been described as intensive and collaborative, ideally incorporative and evaluative training for teachers.

The varieties of approaches to refresher training include school based in-service training, cluster based in- service training, consultation, coaching, and communities of practice, lesson study, mentoring, reflective supervision, technical assistance among others. Students' achievement is linked to numerous factors, but quality refresher training to teachers is one of the most important components of students' success. If school teachers do not have the tools they need to teach students effectively, their students will suffer the consequences. To teach effectively, teachers need access to ongoing refresher training to teacher professionally.

This refresher training on Dienes multi-based blocks resources will professionally develop teachers to improve on mathematics in general through seminars, workshops, and classes. Through this refresher training teachers will learn new teaching strategies to improve the quality of instruction to teach place value with the help of Dienes multi-based resources. This allows them to make changes in the way they teach place value to basic six pupils. Denies multi-based

block resources teaches teachers how to work with a variety of learning styles, since not all students learn the same way. It also helps teachers change their day-to-day teaching methods, encouraging them to accept new methods based on accurate education research (American Federation of Teachers,1995).

According to Sloman (2005), training has been defined as a planned process to modify attitude, knowledge or skill behaviour through learning experience to achieve effective performance in any activity or range of activities. Its purpose, in the work situation, is to develop the abilities of the individual and to satisfy current and future manpower needs of the organisation.

Training endeavours to impart knowledge, skills and attitudes necessary to perform job-related tasks. It aims to improve job performance in a direct way. Training characterised as an instructor-led, content-based intervention leading to desired changes in behaviour.

According to Barron and Hagerty (2001), if employees are to experience flexibility and effectiveness on the job, they need to acquire and develop knowledge and skills, and if they are to believe that they are valued by organization they work for, then they need to see visible signs of management's commitment to their training and career needs. Training is the process of investing in people so that they are equipped to perform.

According to Cole (2002), factors influencing the quantity and quality of training activities include; the degree of change in the external environment, the degree of internal change, the availability of suitable skills within the existing work-force and the extent to which management sees training as a motivating factor in the work place.

Refresher training is the process where a person learns a job by actually doing it. Gary (2003), the study done by Chege, Musiega and Otuko, (2003) concluded that it is not enough just to

throw training to employees and hoping for the best from them. They found out that most of the training is not tied to the institution's goals as it often conducted in a vacuum, which is unrelated to the problems faced by the institution. This means that training results are considered less important than the activity itself because the institution is satisfied as long as the employees attend.

Training is a planned and systematic effort by which heads of institutions aim at altering behaviour, and encouraging employees in a direction that will achieve institutional goals. One of the key known benefits of training is the motivation it provides to those who receive it. Employees who receive training have increased confidence and motivation (Cole, 2002).

Training has the distinct role in the achievement of an organizational goal by incorporating the interests of organization and the workforce. Training is the most important factor in the business world because it increases the efficiency and the effectiveness of both employees and the organization. The employee performance depends on various factors. But the most important factor of employee performance is training (Stone, 2002).

Training is important to enhance the capabilities of employees. The employees who have more on the job experience have better performance because there is an increase in both skills and competencies because of more on the job experience, employee development encourage self-fulfilling skills and abilities of employees, decreased operational costs, limits organizational liabilities and changing goals and objectives (Nickels, 2009).

A refresher training to teachers give teacher positive effect on student learning and development through a combination of content mastery, command of a broad set of pedagogic skills, and interpersonal skills. Proper training to teachers are life-long learners in their subject areas, teach

with commitment, and are reflective upon their teaching practice. Refresher training help teachers to transfer knowledge of their subject matter and the learning process through good communication, diagnostic skills, understanding of different learning styles and cultural influences, knowledge about child development, and the ability to marshal a broad array of techniques to meet student needs (Center for High Impact Philanthropy, 2010).

2.1.3 Significance of Refresher Training

According to Bodanapu (2013), some significance of refresher training are:

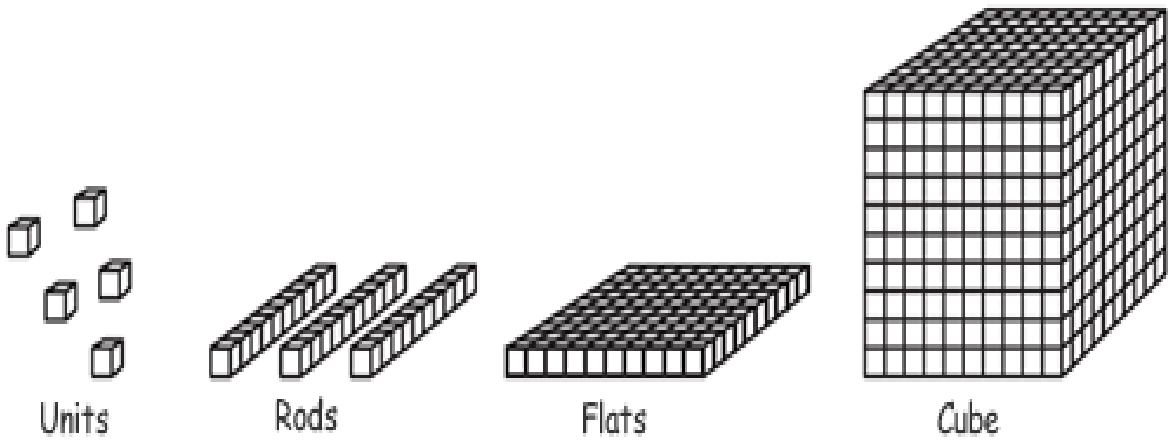
- To update workers with the new technologies.
- To get the best out of your workers.
- To update with the latest trends.
- To retain the existing talent of employee.

2. 1. 4 Concept of Dienes Multi-based block resources

Educationists and psychologists such as Jean Piaget, Maria Montessori and Zoltan Dienes have done several researches into Mathematics with the aim of designing suitable teaching materials to make the teaching and learning of Mathematics easier and to remove the aura of fear in the subject. Some studies into fractions led to the discovery of useful teaching and learning materials such as the fraction board, base ten blocks and the number grid. Further search into addition, subtraction and place value also gave rise to strategies such as the abacus and bundles of sticks. Dienes emphasized that the use of blocks could also make the teaching and learning of place value easier. These blocks he termed the multi-base blocks resources.

Dienes multi-based block resources provide a special model to teach place value at the basic schools. The smallest units that measure 1 cm on a side are called cubes. The rods, narrow blocks that measure 10 cm by 1 cm by 1 cm are called longs. The flat, square blocks that measure 10 cm by 10 cm by 1 cm are called flats. The largest blocks available, cubes that measure 10 cm on all sides, are called blocks. When working with base ten place value experiences, the researcher commonly use the cubes to represent ones, the long to represent tens, the flat to represent hundreds, and the block to represent thousands. Providing names based on the shape rather than the value allows for the pieces to be renamed when necessary. For example, when studying decimals, a class can use the flat to represent a unit and establish the value of the other pieces from there.

Figure 1. Dienes Multi-Based Resources



Source: Dienes, 1960

The size relationships among the blocks make them ideal for the investigation of place value number concepts. Students should explore independently with Dienes multi-based block resources

before engaging in structured activities. As learners move the blocks around to create designs and build structures, and may be able to discover on their own that it takes ten (10) of a smaller block to make one of the next larger block. Students' designs and structures also lead them to employ spatial visualization and to work intuitively with the geometric concepts of shape, perimeter, area, volume among others.

Dienes multi-Based block resources are especially useful in providing students with ways to physically represent the concepts of place value in addition, subtraction, multiplication, and division of whole numbers. To build number combinations in base ten, by using Dienes multi-based blocks, students ease into the concept of regrouping, or trading, and are able to see the logical development of each operation. The blocks provide a visual foundation and understanding of the algorithms children use when doing paper-and-pencil computation (Dienes, 1960).

According to WAEC (2006), have recommended the use of effective instructional methodologies that involve practical, child-centeredness, students' friendly, manipulative and representations in mathematical teaching and learning process, which are capable of arousing students' interest there by improving their performance.

Dienes multi-based block resources are used as a practical learner-centred minds-on and hands on innovative method of teaching especially difficult concepts in mathematics. It is a cognitive approach to meaningful mathematics instructions. Diana & Hilbert (1988), this was invented by 20th century renowned Hungarian mathematician called Zoltan Paul Dienes. He devised this approach to demystify the learning of mathematical concepts especially by the youth. The researcher believes that the teaching of mathematical concepts should be approach through physical or practical means so that child's mind is taken from mere association to complete

generalization there by easing out abstractness found in mathematics.

The researcher designed an apparatus (box) called Dienes multi-based block resources for teaching arithmetic in various forms like place value, number bases, arithmetic operation, decimal fractions etc. It is a type of manipulative but made of cubes or units.

According to Obodo (2004), found that experimental classes which received instruction using Dienes multi-based blocks approach demonstrated superiority over control group in the posttest scores. According to Thompson (1994), also found that Dienes multi-based blocks resources approach improved significantly eight grade student achievement and interest in decimal fraction.

According to Obodo (2004), Dienes blocks is applied using base ten but can be easily decomposed in to other bases. The relationship between unit-line-square block is based on the idea of place value and it significance. According to Imoko and Agwagah (2006), the researchers observed that the use of this approach arouses interesting students due to curiosity. This approach brings improvement and significant interest must have been as a result of variety of activities, which characterised Dienes approach, where learner must fully be involve in fun-like, practical and interesting activities.

These hands-on and minds-on activities must have empowered and enable all learners with different characteristics and abilities to benefit greatly from the variety of the learning experience provided by this approach.

2.1.4 Concept of Place Value

Parling (1985) stated that place value form large part of mathematics and children in Primary

Schools spend many hours each day dealing with simple operations that are basically place value. This implies that children need to understand the ideas under place values operations.

Staszkows and Bradshaw (2004) defined a number as a quantity that answers the questions “How much?” or “How many?” They differentiated between numbers and numerals by saying that numbers are given a name in words and are represented by symbols. The symbols that are used to represent numbers are referred to as numerals. A system of numeration was also defined as consisting of a set of symbols and a method for combining those symbols to represent numbers. Some numeration system that has ever being used includes the Babylonian (3400BC), Iconic Greek (450 BC), May an (300 BC), Roman (200 BC), Chinese (200 BC) and Hindu Arabic (825 BC). According to Bassarear (2007), the numeration system we use today is that of the Hindu Arabic numeration system.

2.2 THE HINDU-ARABIC NUMERATION SYSTEM

Fuson (1999) states that the Hindu-Arabic place value numeration system is based on the principle of collection and the exchange of group of ten (10). In this system, ten (10) ones can be traded and represented by one group of ten (10), ten (10) groups of 10 each can be exchanged and represented as one hundred (100), ten (10) groups of one hundred (100) each can be regrouped and represented as one thousand (1,000), and so on. This mechanism of collection and exchange makes possible a system in which only one ten (10) unique symbols are necessary to express any quantity.

The total value of a number is determined by multiplying each quantity by the value of its position or place and then adding all those values together. The following example indicates how the total value is found for 47 and for 385.

(4 X10) + (7 X 1) = 47

(3 x 100) + (8 X 10) + (5 X 1) = 385

Several important properties of the base-10 place value system include:

1. Ten unique symbols (0–9) express any numerical quantity.

2. The value of each base-10 place is multiplied by 10 as the digits move to the left from the ones place.

Table 1: Position of Numbers

Quantity:	4	3	2
Place Value:	100	10	1
Total Value:	400	30	2

Source: Bassarear, 2007

Place value is extremely significant in mathematical learning, yet students turn to neither acquire an adequate understanding of place value nor apply their understanding of place value when working with computational algorithms (Fuson, 1999).

The understanding of the concepts of place value system is central to develop number sense and it is also the basis the four fundamental operations on numbers. Place value systems are termed positional systems because the value of a number is determined in part by the position or place it holds. In a decimal place value system, for example, each digit represents a group or base of 10.

Place value "pertains to an understanding that the same numeral represents different amounts depending on which position it is in.

The place value concept enables us to represent any value using ten (10) symbols zero to nine (0–9) and compute using whole numbers. Other positional or place value systems include those based on groups of twelve (12), as seen in clock time for counting hours, or groups of sixty (60), for minutes in the hour.

Place value is perhaps the most fundamental concept imbedded in the elementary and middle school mathematics curriculum. Correctly solving problems that involve computation of whole and rational numbers is dependent upon understanding and expressing multi -digit quantities (Schmittau & Vagliardo, 2006). It is absolutely essential that students develop a solid understanding of place value concepts by the end of grade six. Students need many instructional experiences to develop their understanding of the systems including how numbers are written (Charlesworth & Lind, 2003).

National Council of Teachers of Mathematics (2000), yet, knowing when to exchange groups of ones for tens or how to handle a zero in the hundreds place when subtracting, for example, confuses many students who then struggle with algorithms. Learners can correct these and other misunderstandings by solving real-world problems with hands-on materials and learning aids such as Dienie multi-based blocks resources, counters, abacus, place value charts, fractional board, bundle of ten sticks and loose ones and many more. Understanding and fluency are related and there is some evidence that understanding is the basis for developing procedural fluency (Kilpatrick, Swafford & Findell, 2001).

Research indicates that students' experience using physical models like Dienis multi-based blocks resources to represent hundreds, tens, and ones can be effective in dealing with place value issues early in the curriculum. The resources will help them think about how to combine quantities and eventually how this process connects with written procedure (Kilpatrick et al. 2001).

Dienie multi-based blocks resources available does not insure that students will think about how to group the quantities and express them symbolically National Council of Teachers of Mathematics (NCTM, 2000), rather, students must construct meaning for themselves by using Dienis multi-based blocks resources to represent groups of tens in classroom discussions and in authentic, cooperative activities.

2.3 THEORETICAL FRAMEWORK

This study is backed by the theory of learning and intellectual development of children by Piaget. Adaptation explained by Piaget is the ability of a child to interact with his environment. Therefore, the researcher considers this theory as a means to help learners to learn place value in Nabulugu D/A primary school.

The following quotation supports the assertion that the learning environment should always be made conducive and attractive for learning (Simatwa, 2010). Piaget's theory asserts that intellectual development is a direct continuation of inborn biological development. That is the child is born biologically equipped to make a variety of motor responses, which provide them with the framework for the thought processes that follow. That is, the ability to think springs from the physiological base. Piaget maintains that intelligence is rooted in two biological attributes found in all living creature: organization and adaptation. Organisation is the tendency of every living organism to integrate processes into coherent systems. It occurs, for instance,

when an infant, originally capable of either looking at objects or grasping them, integrates these two separate processes into a higher order structures which enable him to grasp something at the same time he looks at it.

Adaptation is the innate tendency of a child to interact with his environment. This interaction fosters the development of a progressively complex mental organization. Each stage in this sequence of development provides the foundation for the next stage permitting progressively complex and effective adaptations to the environment.

Adaptation comprises two complementary processes of assimilation and accommodation. The child assimilates experiences and fits them into the expanding structure of the intellect when he encounters new experiences which he cannot fit into the existing structure accommodation, or modified way of reacting takes place.

Piaget stresses that as children mature mentally, they pass sequentially through four major stages of cognitive development, each stage having several sub stages. The major stages of cognitive growth are:

- Sensory motor stage - 0 - 2 years
- Preoperational stage - 2 - 7 years
- Concrete operations stage - 7 - 11 years
- Formal operations sage - 11 - 15 years

These stages are of a probabilistic nature. At most ages, it is possible for a child to exhibit behaviour characteristic of more than a single stage because heredity interacts with environment. Each stage is a system of thinking that is quantitatively different from the preceding stage.

Each stage is a major transformation in thought processes compared to the preceding stage. The stages are sequential and follow an invariant sequence. This means that the child cannot skip or miss a stage or by - pass a stage. The learner must go through each stage in a regular sequence. Children cannot overcome a developmental lag or speed up their movement from one stage to the next. Learners need to have sufficient experience in each stage and sufficient time to internalize that experience before they can move on.

Hence, a child needs to go through these stages before she/he becomes fully equipped with the knowledge needed for later life. This is done through the use of appropriate teaching and learning materials at each stage of the child's development. Bruner (1966) explained that Instruction consists of leading the learner through a series of activities of a problem or body of knowledge that increase the learner's ability to assimilate, transform, and transfer what learner is learning. In short, the sequence in which a learner encounters materials within a domain of knowledge affects the difficulty of learner will have in achieving mastery

If it is true that the usual course of intellectual development moves from enactive through iconic to symbolic representation of the world, it is likely that an optimum sequence will progress in the same direction

Instruction is a situation that helps the learner to be a problem-solver self-sufficient. Therefore, the teacher must correct the learner in a nice way that will make it possible for the learner to take over the corrective function himself. This can be achieved through the use of teaching and learning materials that are appealing to the child.

The use of Dienes multi-based resources will support teaching and learning, is one of the most important areas that should be encouraged by all teachers most especially in teaching

mathematics as a subject in the national curriculum.

2.4 CONCEPTS OF TEACHER LEARNER RESOURCES

Tamakloe, Amedahe and Atta (2005) defined teaching learning resources as a material which the teacher uses to facilitate the learning, understanding and acquisition of knowledge, concept, principles or skills by his students.

It is real that some teachers prefer the use of lecture method to practical method of teaching. Many efforts have been made in the corporate countries including Ghana to make teaching flexible for economic importance and national development. In this sense, teachers need to teach all subjects in schools by adopting the use of appropriate relevant resources to sustain the interest of learners during instructional hours.

Klaus (2010) posited that teaching learning resources are tools that classroom teachers used to help their students learn quickly and thoroughly. They are the tools used to convey meaningful information in the classroom. In education, teaching learning resources are the equipment and materials that are relevant to motivate, inform, instruct and present the right content to the learners. Teaching learning resources may be only materials which the teacher prepares and uses in the classroom to facilitate learning in mathematics.

Mialaret (1996), said that teaching learning resources help the teacher but does not replace him in teaching and learning processes. In addition teaching learning resources are aids which help students to use the five senses of the human during the instructional process. This also contributes to the fact that teaching learning resources will support the effort of the teacher to bring understanding of concepts, ideas, facts and others to better the students. The five senses will help the students to hear, feel, touch, smell, manipulate, see and apply in a real life situation.

Most learners learn through playing with teaching learning resources.

According to Wood (2004), has alluded to the fact that, play enhances language development, social competence, creativity, imagination and thinking skills. Play is the chief vehicle for the development of imagination and intelligence, language, social skills and perceptual-motto abilities infants and young children.

According to Frost (1992), play is an important activity that develops learners holistically. According to Fromberg and Gullo (1992), it is closely tied to the development of the socio-emotional, cognitive, language and physical behaviours. It is innovative project in attempt to guide teachers to understand the use of multi-based block relationship between resources and teaching practice in the classroom to improve quality education.

Wickham and Versveld (1998), investigated the ways in which classroom materials drive teachers' practice. It was based on the premise that access to good multi- based block resources will improve teachers practice and enrich learning environment. A critical examination of the use of multi-based block materials in teaching place value in the classroom will require a close examination of the purpose for which the resource is used, how it is used and how the learning is organized. Furthermore the nature of the resources influence the way the teacher uses it. How children and teachers understand the significant of the resources choose.

Sollaer (2003), also acknowledge the importance of play as a tool to develop children holistically. Multi-based materials should be available for pupils to play and manipulate with them to their satisfaction. This can help greatly to bring the desired results anticipated. Instructor should therefore, adopt the use of multi-based block as teaching and learning materials teaching place value is a process to help develop learners cognitive, social, emotional, physical and moral

development.

2.5 CONCLUSION

The literature review looked at the following key areas: mathematics education, refresher training, concepts of Dienes multi-base block resources, place value and concepts of teaching learning resources. Dienes view on mathematics education is that it should be taught at the basic school level with a lot of teaching and learning materials in order to lay a solid foundation for the pupils. This is in line with the theory backing this research which states that learners' ages should be considered when planning lessons and the right teaching and learning materials should be selected in order to achieve good results.

From Wood, (2004), has alluded to the fact that, play enhances language development, social competence, creativity, imagination and thinking skills. Play is the chief vehicle for the development of imagination and intelligence, language, social skills and perceptual-motto abilities infants and young children. This is in line with the researcher to use Dienes multi-based block resources to help learners understand place value in the school.

Erik's idea on learning is that learning is said to have taken place when the learner is able to memories and reproduce what has been learnt. Hence, the researcher agrees with his idea because when concept or idea is taught to children, the instructor expects the learner to perform well during test. This is in line with the theory backing this research because Brunner's idea of Instruction consists of leading the learner through a series of activities of a problem or body of knowledge that increase the learner's ability to assimilate , transform, and transfer what he is learning. Hence, the researcher strongly agrees with Erik's idea. In conclusion, the researcher's work is to enhance learners understanding through the use of Dienes multi-based block resources

at the primary school.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

This chapter will present and discuss each of the following: the profile of the study area, the research design used, the population of the study area, sample and sampling techniques respectively, data collection instruments, data collection procedure, pre-intervention procedures, the intervention strategies, post-intervention process, data is analysed, data quality, and ethical issues and conclusion.

3.1. PROFILE OF STUDY AREA

Nabulugu D/A primary school is located at the Kparigu in the Walewale District in the Northern Region of Ghana. Majority of the people are farmers, traders, while a few are salary workers, either with the government or private organisations.

Nabulugu is a community with the natives being Mamprusi by tribe and they are the largest. Other tribes include Farafara, Hausa, Fulani, Bimoba Konkoba and Talisi. Most of these people are engaged in several vocations include farming and trading. Nabulugu D/A Primary School was established in 1979. The reason of its establishment was that parents in the community used to send their wards to Schools at Kparigu, Tinguri, Gbani and Walewale. The parents found it necessary to establish a School in the Village where they can monitor, supervise, evaluate teaching and learning progress in the School.

The P.T.A/S.M.C realized the need for a permanent structure Due to the effective management and academic performance of the school over the years, the school was selected as one of the

feeding schools in the district. The school has a total population of three hundred and fifty five (355) pupils of which 127 are females and 228 are males. The Kindergarten 1 and 2 which are one stream each like the primary, The school currently has staff strength of seven (7). Six (6) are males and one (1) is female.

3.2 RESEARCH DESIGN

The qualitative research design was adopted by the researcher for this study. Qualitative research is the approach usually associated with the social constructivist paradigm which explains the socially constructed nature of reality. It is about recording, analysing and attempting to uncover the deeper meaning and significance of human behaviour and experience, including contradictory beliefs, behaviours and emotions. It is aimed at gaining a rich and complex understanding of people's experience (Alzheimer Europe, 2009). Qualitative research is concerned with the systematic collection, ordering, description and interpretation of textual data generated from talk, observation or documentation. Qualitative research methods include the techniques of interviewing, observation, and document analysis. Its goal is to explore the behaviour, processes of interaction, and the meanings, values and experiences of purposefully sampled individuals and groups in their "natural" context (Simon, Janice & Carol, 2008).

Quantitative research also seeks a deeper truth of a problem which enables researchers to study things in their natural setting attempting to make sense or interpret phenomena in terms of the meanings people bring to them and therefore, uses the holistic perspective to preserve the complexities of human behaviour (Greenhalgh, 1997).

Qualitative research is concerned with developing explanations of social phenomena. That is to say, it aims to help us to understand the world in which we live and why things are the way they are

(Hancock, 1998). He added that qualitative research is concerned with the social aspects of our world and seeks to answer questions about:

- Why people behave the way they do
- How opinions and attitudes are formed
- How people are affected by the events that go on around them
- How and why cultures have developed in the way they have
- The differences between social groups

Qualitative research is concerned with finding the answers to questions which begin with: why? How? In what way? and others.

Advantages of qualitative research, according to Hancock (2002), are that it describes social phenomena as they occur in their natural setting. This implies that qualitative research gives a distinct and rich approach to understanding what, how and why events occur in their natural settings. He added that Qualitative research is concerned with the opinions, experiences and feelings of individuals producing subjective data. Understanding of a situation is gained through a holistic perspective. Quantitative research depends on the ability to identify a set of variables. Data are used to develop concepts and theories that help us to understand the social world. Qualitative data are collected through direct encounters with individuals, through one to one interviews or group interviews or by observation.

However, some weaknesses associated with qualitative research are that data collected is time consuming because it takes place through direct encounter with participants such as interviews or

observations. Large samples cannot be worked with due to the intensive and time consuming nature of how data is collected; hence small group is preferred to be able to work within the stipulated time.

The researcher uses the action research method to enable him use locally available materials to train upper primary teachers on designing a circuit board to teach basic electronics at the upper primary in Pong-Tamale Experimental Primary School. Action research is a process of systematic inquiry that seeks to improve social issues affecting the lives of everyday people (Stringer, 2008). According to Mills (2011) as cited by Hine (2013), action research is an attractive option for teacher researchers, school administrative staff, and other stakeholders in the teaching and learning environment to consider.

3.2.1 Reasons for Adopting the Qualitative Research Design

The researcher adopted the qualitative research design because the study does not involve in statistical procedure for investigation, hence the qualitative research design helped the research to study deep into the problem. It was appropriate to adopt the qualitative research design since it enables one to find out the availability and the usage of Dienes multi-based block resources to teach basic pupils place value in mathematic sat Nabulugu D/A Primary School. The qualitative design was also selected to study how Dienes multi-based block resources as teaching and learning materials are made up of, how the materials would help both teachers and pupils during teaching and learning of place value in Mathematics in the selected school. Qualitative data gathered were studied and analysed to produce a meaningful picture of how teaching and learning materials are used in the selected primary school for teaching place value in mathematics primary school.

3.3 POPULATION OF THE STUDY

A population is a group of elements or cases, whether individuals, objects, or events, that conforms to specific criteria and to which a researcher intends to generalise the results of the research Asamoah-Gyimah, (2007). This means that the groups the research have interest to work with and which the results can be generalised.

The population for the study was the circuit supervisor, the head teacher and six (6) primary teachers. Hence, the population for this study was eight (8).

3.4. SAMPLING TECHNIQUE

Sampling technique adopted for this study had an effect on how the results can be generalised. In this study the purposive and convenience sampling techniques were employed for the study. The purposive sampling technique, also called judgment sampling, is the deliberate choice of a participant due to the qualities the participant possesses. It is a non-random technique that does not need underlying theories or a set number of participants. The researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience. It is typically used in qualitative research to identify and select the information-rich cases for the most proper utilization of available resources (Etikan, 2016).

Purposive technique was adopted to select the head teacher, teachers and pupils for the study because this category of people had knowledge on teaching and learning materials. According to Etikan (2016), Convenience sampling (also known as Haphazard Sampling or Accidental Sampling) is a type of non-probability or non-random sampling where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity,

availability at a given time, or the willingness to participate are included for the purpose of the study. Therefore, the researcher used convenience sampling technique to select the primary school for the study since it was close to the researcher. This saved the researcher time from travelling long distance for data collection and analysis. Hence, the sample size for this study was 143 which represent 100% of the accessible population and also 76% of the target population of the study.

3.5 DATA COLLECTION INSTRUMENTS (ACTION RESEARCH TOOLS)

The types of data that were collected for the study were primary and secondary data. Primary data are fresh (new) information collected for the first time by a researcher himself for a particular purpose. It is a unique, first-hand and qualitative information not published before. It is collected systematically from its place or source of origin by the researcher himself or his appointed agents. It is obtained initially as a result of research efforts taken by a researcher (and his team) with some objective in mind. It helps to solve certain problems concerned with any domain of choice or sphere of interest. Once it is used up for any required purpose, its original character is lost, and it turns into secondary data (Akrani, 2014).

Hence, primary data collected by the researcher included field notes and pictures from observing classroom teaching and learning of mathematics and interviews with head teacher and primary teachers at Nabulugu D/A Primary School. According to Akrani (2014) again explained that Secondary data are information already collected by others or somebody else and later used by a researcher (or investigator) to answer their questions in hand. This data is usually obtained mostly from different published sources like companies' reports, statistics published by

government, etc. Here the required information is extracted from already known works of others (e.g. Published by a subject scholar or an organization, government agency, etc.).

Therefore, Secondary data was gathered by the researcher from books, online documents, journals, published and unpublished thesis, school records and other documents that are related directly to mathematics and the use of Dienes multi-based block resources, as resources to teach place value at the primary school level in Ghana, among others. The researcher adopted interview and observation as instruments for data collection for the research work.

3.5.1 Interview as a tool for data collection

An Interview is a conversation carried out with the definite aim of obtaining certain information and again, it is interview is design to gather valid and reliable information through the responses of the interviewee to a planned sequence of questions (Asamoah, 2007). This means that an interview is a mutual interaction between an interviewer and interviewee to find out about information regarding a situation.

According to Rita (1999), interview is a type of interaction which researchers use to elicit information in order to achieve a holistic understanding of the interviewee's point of view. It can also be used to explore interesting areas for further investigation. This type of data collection process involves asking informants open-ended questions, and probing wherever necessary to obtain data deemed useful by the researcher for a study most especially for qualitative data collection. Interview can be structured, semi-structured and unstructured.

The researcher employed unstructured interview to find out the state, usage and benefits of using improvised teaching and learning materials, the nature of refresher training they have undergone at Nabulugu D/A primary school. The circuit supervisor was also interview on how teachers use

those materials during monitoring and supervision and how often the district organises refresher trainings for teachers on TLMs preparation and usage. Dialogue was adapted to interview participants to ensure that they were comfortable to express themselves and willing to share information on the subject matter very well.

3.5.2 Observation as a tool for data collection

Observation is a careful study and recording results of events such as activities, behaviours, actions and other aspects of human behaviour for the benefit of fulfilment of a task or study.

Observation is way of gathering data by watching behaviour, events, or noting physical characteristics in their natural setting. Observations can be overt (everyone knows they are being observed) or covert (no one knows they are being observed and the observer is concealed). The benefit of covert observation is that people are more likely to behave naturally if they do not know they are being observed. However, you will typically need to conduct overt observations because of ethical problems related to concealing your observation (Education Evaluation Team, 2008).

Education Evaluation Team (2008) again added that, Observations may also be either direct or indirect. Direct observation is when you watch events such as interactions, processes, or behaviours of people as they occur in their natural setting; for example, observing a teacher teaching a lesson from a written curriculum to determine whether they are delivering it with fidelity.

Indirect observations are when you watch the results of interactions, processes, or behaviours without participant's awareness that they are being observed. But because of ethical issues, this method may not be acceptable. Hence, the researcher employed the direct observation as a tool for data collection.

The justification for using observation as a tool for data collection was that observation was used to get much information on how mathematics is being thought at the primary school in Nabulugu D/A primary school, the kind of materials used during lesson delivery, pupil's reactions towards mathematics lessons, and availability of TLMs and how they are made or produced and finally, the methods used by teachers to deliver mathematics lessons.

3.6 DATA COLLECTION PROCEDURE

The procedures employed by the researcher in this study are as follow:

3.6.1 Situational analysis (pre-intervention)

Situational analysis is a way of identifying and analysing the state of a problem and how to solve the problem or make changes that can improve upon an existing problem. A situational analysis is a systematic collection and evaluation of past and present economic, political, social, and technological data, aimed at identifying internal and external forces that may influence the classroom or organization's performance and choice of strategies and assessment of the classroom or organization's current and future strengths, weaknesses, opportunities, and threats (Business Dictionary, 2017).In view of this, the researcher conducted a needs assessment to find out the state of the identified problem in detail.

Permission was asked from the head teacher in the selected school through writing to carry out a situational analysis of the problem, which was the use of Dienes multi-based block resources in teaching and learning place value in mathematics at Nabulugu D/A primary school.

3.6.1.1 Main findings during the situational analysis using the research tools:

- **Interviews**

The researcher carried out three sets of unstructured interview. The first one was with the head teacher. The researcher asked about his qualification, years of experience in the teaching field, his age, number of years as a head and number of in-service training he has organised and attended for 2017/2018 academic year. The interaction with the head teacher revealed that some teachers in the school teach without using Dienes multi-based resources, some classroom teachers state the Dienes multi-based block resources in their lesson notes but they don't use them during teaching and learning process and others lack the skills in handling and manipulating Dienes multi-based block resources in teaching place value. He added that the school has organised a number of in-service training but Dienes multi-based block resources as TLMs usage was not part of the training. The second interview was with six teachers. Four of the teachers remarked that preparing TLMs is tedious and therefore, they use TLMs drawn in the pupil's texts books. One teacher said that he prepares TLMs sometimes to deliver lessons and the sixth teacher also remarked that TLMs are costly to purchase and therefore, he resorts to the few sophisticated TLMs available to deliver lessons.

The final interview was scheduled with the circuit supervisor. The researcher arranged with him to choose a convenient date which took place at the District education office five (5) days after the interview with the teachers and head of the school. According to the circuit supervisor, most teachers lack the skills of improvisation. He said this is realised during his usual monitoring and supervision. He also stated that it is common to see a teacher teaching for a whole term without preparing and using self-made TLMs to deliver lessons. The researcher asked how often the

directorate organises training for teachers and areas where they organise these training on. He responded that the directorate has organised training in Early childhood (early grade reading), numeracy for lower and upper primary, literacy for lower primary and leadership for head teachers. Mathematics especially Dienes multi-based block resources usage was not stated by the circuit supervisor.

- **Observation**

Observation of lessons was also made in all the classes of the school. It was revealed that some teachers failed to use the active learning approach (child centred method) of teaching to deliver lessons which is usually done with enough TLMs; rather they still use the lecture method to deliver lessons. According to Bell & Kahrhoff (2006), active Learning is a method of teaching whereby students are actively engaged in building understanding of facts, ideas and skills through completion of teacher directed tasks and activities. It is also any type of activity that gets all students involved in the teaching and learning process. Hence, the active learning approaches paramount when it comes to learning process but it was a different picture during the lesson observation.

This made some of the students sleeping and some were making noise and doing different things all together during learning process. It was realised that teachers still use the traditional seating arrangement in the class that is on rolls in the primary level which does not help during learning process.

- **Document Review**

Document review is a process of examining existing documents to ascertain facts about a situation. These records are reviewed to find out the state of the existing problem. Document

review is a way of collecting data by reviewing existing documents. Documents may be hard copy or electronic and may include reports, program logs, performance ratings, funding proposals, meeting minutes, newsletters, and marketing materials (Education Briefs, 2009).

The researcher reviewed teacher's lesson notes to see how teachers incorporate Dienes multi-based block resources in to teaching and learning their lessons. It was realised that some teachers do indicate Dienes multi-based block resources but they don't use them during learning process and some do not even show how to use the materials in the activities column of the lesson plan. Hence, the researcher planned to organise a short training session for the selected teachers to update their knowledge on how to use Dienes multi-based block resources to place value. The material will be used to demonstrate at the basic six levels in the school.

Another document that was reviewed is in-service training file to determine the frequency of how in-service training is organised in the school, especially on TLMs preparation and usage in mathematics. It was revealed by the head teacher that the school has organised a number of in-service training but that did not include the preparation of TLMs and usage. Hence, the need to organise this training session to help bridge that gap in the selected school. The researcher also reviewed documents on the existing TLMs in the school. It was revealed that the school depends greatly on the few TLMs provided by Ghana Education Service which are woefully inadequate for the school considering the population of the school. TLMs provided were mainly charts and play equipment. According to the teachers, they depend largely on the pictures in the pupil's text books as TLMs to deliver lessons. Pupils exercise books also confirm that the number of exercises given were woefully inadequate. However, the class six teacher used flowers from the environment to teach parts of the flower. All pupils participated well since they all had flowers at their desks to interact with.

3.6.1.2 Challenges experienced during the situational analysis

Some teachers failed to appear during the interview session and gave reasons that they were not prepared for that day. A different date was set for them and this affected the researcher's time for completing the interview on time. The circuit supervisor's date for the interview was also rescheduled because he was to attend to another important function at the directorate.

During the lesson observation, some teachers repeated old lessons which did reflect the actual performance of teachers and pupils during lessons. Classroom management was also a challenge since most of the lessons taught were abstract. Pupils were not engaged or put at the centre of learning process and they made noise which affected the teachers' delivery.

The document review session also had some challenges. Some teachers failed to provide their lesson note books because they were not up to date. Some thought that the results of the finding could be sent to the District directorate even upon assuring them about the confidentiality of the findings and therefore they refused to present their lesson note books. Hence, the above challenges slowed down the time stipulated for the data collection process during the situational analysis.

3.6.2. Intervention

The intervention was to train teachers on how to use Dienes multi-based block resources to teach basic six pupils place value for mathematics education in Nabulugu D/A primary School. In view of this, the researcher identified a gap with regards to the use of these materials for teaching mathematics since most teachers rely heavily on chalk board illustrations, pictures in the pupil's text books and the few charts which were supplied by Ghana Education Service. This prompted the researcher to come out with strategies that can help teachers to be able to deliver lessons

properly by taking them through how to handle, manipulate them to be able to teach place value very well.

An in-service training was organised for the circuit supervisor, the head teacher and six selected teachers at the primary department in the school. According to Handicap International (2014), in-service training is a kind of training organised for teachers who are already working as teachers or qualified as teachers. In-service training can be organised for a group of teachers from different schools, or can be organised for a whole team of teachers in one school (whole-school approach).The significance of in-service training is that, teachers can almost immediately put into practice what they have learned in the training and participants have a lot of experiences that the trainer can build on to help them teach with effectively. The training took two days period and time for it was agreed by the circuit supervisor, head teacher and the teachers. It was decided that the training is organised outside contact hours. The agreed date was 19th October to 20th October, 2017. That was Thursday and Friday. Below is a time table that guided the conduction of the in-service training:

Table 2. 1manipulating Dienes multi-based block resources in teaching place value to basic six pupils in mathematics.

Day 1			**Day 2**		
TIME	**ACTIVITY**	**Personnel**	**TIME**	**ACTIVITY**	**Personnel**
2:00-2:10	Registration	All	2:00-2:05	Opening prayer	Participant

PM			PM		
	Opening Prayer	Participant	2:05-2:20 PM	Recap	All
2:10-2:25 PM	Key note address and introduction of facilitator	Head teacher	2:20-2:30PM	Group work and presentation on the use Dienes multi-based block resources to teach p.6 pupils place value in mathematics	All participant
2:25-2:30 PM	Self-introduction	All	2:30-3:30 PM	To examine the effects of not using Dienes multi-based block resources in primary six mathematics.	Yamusah Tahidu
2:30-2:40 PM	Objectives of the training programme	Yamusah Tahidu		Group work and presentation on	All participant

				the effects of not using Dienes multi-based block resources in teaching place value to basic six pupils	
2:40-3:00 PM	The use of Dienes multi-based blocks resources in mathematics	Yamusah Tahidu		To ascertain the effective use of Dienes multi-based block resources to teach place value to basic six pupils	Yamusah Tahidu
3:00-3:10 PM	**SHORT BREAK**		3:30-3:40 PM	**SHORT BREAK**	
3:10-3:30 PM	Group work and presentation on the uses of Dienes	All participants		Group work and presentation on the effective use	All participant

	multi-based block resources in mathematics			of Dienes multi-based block resources to teach place value to p.6 pupils	
3:30-4:30 PM	To train teachers on the use of Dienes multi-based block resources to teach place value in basic six mathematics	Yamusah Tahidu		Summary of the two days activities	All participant
4:30-4:45 PM	Summary of the day's activities	Yamusah Tahidu	3:40-4:00 PM	Workshop evaluation	All participant
4:45-4:50 PM	Closing prayer and departure	All	4:00-4:10 PM	A thank you note the facilitator, Closing prayer and departure	Head teacher

Source: Field Survey, 2018

3.6. 3 Post-intervention

After the intervention, a demonstration lesson was organised in basic six to see the impact of Dienes multi-based block resources. The enrolment of the class was 43 and the teacher arranged pupils in a “horse shoe” formation. This was done to ensure that all pupils could see the processes involved in manipulating the interactive Dienes multi-based block resources in teaching place value. The teacher introduced the lesson by reviewing pupil’s relevant previous knowledge on operation of numbers linked their responses on the topic ‘place value’. All pupils were very quiet upon seeing the Dienes multi-based block resources. The teacher who received the training demonstrated how to assemble the material to form a cube, long, flat, and block. Pupils were put into five groups. The teacher made them to choose group leaders and each group interacted with the materials. At the end of the lesson, pupils were able to mention the components of Dienes multi-based block resources and were also able to put the materials to solve operations with regards place value.

3.7. DATA ANALYSIS AND PRESENTATION

Data was analysed manually with taking into considerations themes formed based on the objectives of the study and the action research tools –observation and interview.

3.7.1 Activities undertaken for objective one

Objective one was to examine the uses of Dienes multi-based blocks in basic six pupil’s mathematics at Nabulugu D/A primary school.

3.7.2 Activities undertaken for objective two

Objective two was to train teachers on how on the use of Dienes multi-based block resources to teach place value in basic six at Nabulugu D/A primary school. Date and time for the training was agreed by the head teacher and the six teachers. That was 19th October to 20th October, 2017. That was Thursday and Friday after school. The researcher selected the days and time because participants did not want to go contrary to the term scheme of work and the contact hours. Activities for the first day were: registration, opening prayer, training norms, expectations, key note address and introduction of the facilitator by the head of the school, self-introduction, objectives of the training, uses of Dienes multi-based block resources, trained teachers on the use of Dienes multi-based block resources to teach basic six pupils place value. Group work and presentation on manipulating of Dienes multi-based block resources on place value and suggesting topics for the groups, Summary of the day's activities and Closing prayer and departure.

Activities for the second day were: Opening prayer, recap of day one activities, the effects of not using Dienes multi-based block resources to teach place value, ascertain the effective use of Dienes multi-based blocks resources in teaching place value to basic six pupils, workshop evaluation, a thank you note by the facilitator, Closing prayer and departure.

- **Observations made during the refresher training**

All participants reported to the training venue on time and that was impressive and a signal that the teachers were dedicated and time conscious. After the opening prayer, self-introduction, norms and expectation, the head teacher introduced the researcher as the facilitator for the 2-day

refresher training. The researcher took participants through the objectives of the training session which were:

i. To state the uses of Dienes multi-based block resources in basic six pupils' mathematics.

ii. To train teachers on the use of Dienes multi-based block resources to teach place value in basic six.

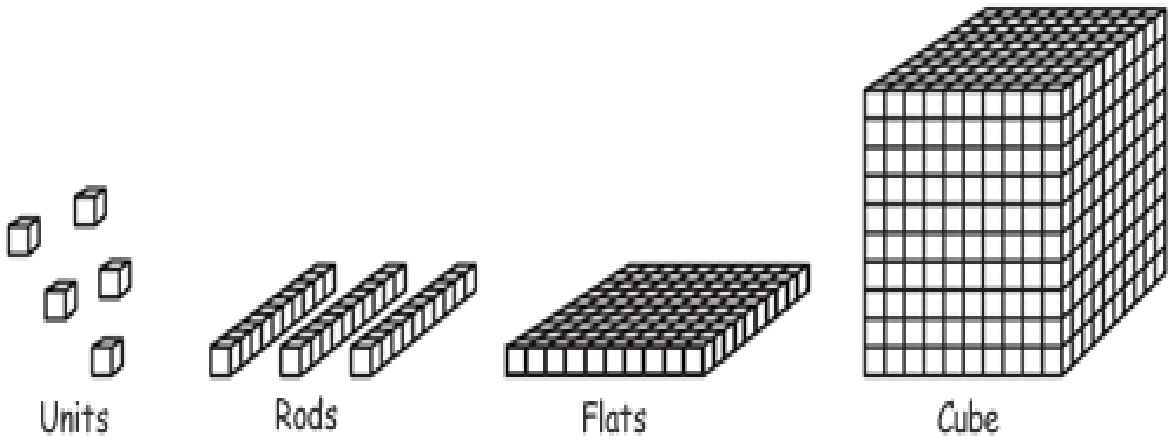
iii. To list the effects of not using Dienes multi-based block resources to place value at basic six pupils.

iv. To ascertain the effectiveness of Dienes multi-based block resources to teach basic six pupils place value.

Participants were put in a semi-circle seating arrangement which allowed each participant to see clearly what was demonstrated. The first day was used to achieve activity one and two while objective three and four was catered for the second day due to the time consuming nature of blocks. Participants were put into two groups. Group one answered question two and group two answered question one. After the group work, participants did presentation of their work. All participants made inputs to both presentations and that was refreshing to everybody.

Day two was used to examine the effects of not using Dienes multi-based block resources in teaching place value at basic six mathematics, and critical examine effectiveness of this materials.

Figure 2: Dienes Multi-Based



Source: Dienes, 1960

Dienes' Block consists of a block of 1000 unit cubes. This block comprises of unit, long, flat (square), block and groups of blocks as the case may be. A unit is a cube of 2×2×2 cm3 in dimension. A long (line) contains some cubes depending on the base, for-example base 3. A flat square contains 9 cubes and a block contains 27 cubes (Obodo, 2004). Dienes' Block is applied using base10 but can be easily decomposed into other bases. The relationship between unit-line-square-block is based on the idea of place value and its significance. This block is used in solving problems involving conversions and mathematical operations of plus, minus, multiplication, division and number bases practically. Its practical activities could make solving problems in number bases very interesting, fascinating, fun, pleasurable and involving.

Those for the experimental group were exposed for two days on the rudiments of Dienes' Block approach and on the essence of the study. The lesson plans for the study was properly explained to them and they were advised to adhere strictly to the content and rudiments of this approach for a reliable result.

The components were used to solve several questions in mathematics. After the demonstration by the researcher, all participants were made to take out the components and solved similar place value questions. The head teacher and five other teachers went through and only one teacher had challenges but he was supported by one of the participants. Next was the evaluation of the training. Areas which were evaluated were: expectation, venue, facilitation, time, content and expectations. Below is a diagrammatical representation of the evaluation:

Table 3. Diagrammatical representation of evaluation of the training programme

AREA ASSESSED	**NUMBER OF PARTICIPANTS WHO GRADED POOR**	**NUMBER OF PARTICIPANTS WHO GRADED GOOD**	**NUMBER OF PARTICIPANTS WHO GRADED VERY GOOD**	**NUMBER OF PARTICIPANTS WHO GRADED EXCELLENT**
Expectation	0	0	1	6
Venue	0	1	2	4
Facilitation	0	0	0	7
Time	0	2	3	2
Content	0	0	0	7
Participation	0	0	0	7

Source: Field Survey, 2018

The researcher thanked all participants for spending time to take part in this refresher training and making it a success.

3.7.3 Activities undertaken for objective three

Objective three was examined the effects of not using Dienes multi-based block resources in solving place value questions. Participants were group in two mentioned some of the effects of not using Dienes multi-based block resources in teaching place value in the primary school.

3.7.4 Activities undertook for objective four

In basic 6, the teacher introduced the lesson by reviewing pupils' relevant previous knowledge on position of numbers. He linked that to place value. He took pupils through how to handle and manipulate Dienes multi-based block resources with regards to place value. At this point, pupils upon seeing the materials on the table were happy and the whole class was quite. This sustained pupil's interest throughout the lesson. Time was given to pupils to assemble Dienes blocks to solve place value questions in groups. The teacher explained the functions of the various parts of the blocks. He used this as an opportunity to teach pupils the concept of four operations using Dienes blocks. The teacher evaluated pupils through oral and writing questions. The oral questions were for pupils to mention some of the resources used and functions in place value. At the end of the evaluation, 40 pupils out of 43 pupils scored all the marks and that was impressive. After the lesson the researcher and the teacher had a discussion on the lesson. He admitted that the presence of the material has made his lesson delivery very lively and pupil's participation was also excellent.

3.8 DATA QUALITY AND ETHICAL ISSUES

Participants were allowed to express themselves through unstructured interview to ensure the quality of the data. This made respondents express themselves well during the interview sessions. Adequacy and accuracy of the sample size was ensured. The researcher took class six (6) in the

upper primary department, the teachers in the primary and the head teacher of the school. This sample was chosen to be able to study deep into the problem.

The researcher asked permission from the head of the sample school through formal writing before embarking on administering of the research instruments because of ethical issues. The researcher also ensured participants about confidentiality of any information that targeted population gave. This was done through an interview guide. Permission was also sorted before embarking on the observation process since. References were also properly made through the use of N-note software.

3.9 CONCLUSION

This chapter has presented and discussed each of the following: the profile of the study area, the research design used, the population of the study area, sample and sampling techniques respectively, data collection instruments, data collection procedure, pre-intervention procedures, the intervention strategies, post-intervention process, data is analysed, data quality, and ethical issues.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 INTRODUCTION

The researcher organised refresher training for teachers on how to use Dienes multi-based resources to teach place value to basic six pupils at Nabulugu D/A primary school in West Mamprusi District. This chapter takes a critical look at demographic characteristics of respondents, results analysis of the pre-intervention, post intervention results and the pitfalls that hindered the effective implementation of the refresher training organised during the intervention process.

4.1. DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS

Personnel characteristics of respondents have essential role to play in expressing and giving the responses about the problem. Some personal characteristics of professional and unprofessional teachers are; gender, age, qualification, rank, years of teaching experience and years of teaching mathematics in basic at the primary school of the eight(8) respondents have been examined and presented in this chapter. Age of the respondents is one of the most important characteristics in understanding their views about the problem. Age indicates level of maturity of individuals which means that age is more important to examine in this study.

4.1.1 Demographic Characteristics of Teachers

The following areas were taken into consideration during the interview session of teachers at the primary school in Nabulugu D/A primary school: gender, their ages, qualification, rank, years of teaching experience and years of teaching mathematics at the upper primary school. Out of the six teachers, five of them were male teachers and only one female teacher. Their ages ranged

from twenty-six to forty-three years. Five teachers had diploma in Basic Education and one teacher had Bachelor's degree in Basic Education. One teacher trained as mathematics teachers, three trained in social studies and the other two did general curse as their elective areas. One teacher had twenty years of teaching experience; two teachers had ten and eleven years of teaching experience, two teachers had two years of teaching experience and one teacher had only one years of teaching experience. Four teachers have being teaching mathematics at the primary school for one, three, five and seven years respectively, two teachers has being teaching mathematics at primary for one year and the other teachers had two years teaching experience of mathematics at the primary school.

4.1.2 Demographic Characteristics of Head Teacher

Demographic characteristics considered for the head teacher in the selected school were: gender, age, qualification, rank, years of teaching as a teacher and years of experience as a head teacher. The head teacher was a male teacher and forty-two years of age. His qualification was Bachelor degree in basic education and also occupied a rank of principal superintendent. He has being teaching for fifteen years and five year as a head teacher.

4.1.3 Demographic Characteristics of the Circuit Supervisor

The circuit supervisor was male and fifty years of age. He holds a Master's degree in social administration and a rank of assistant director I. He has sixteen years of teaching experience and also four years experience as a circuit supervisor in West Maprusi District.

4.2 Discussion of Pre-Intervention and Post Intervention Results.

Below are the findings for the Pre-Intervention and Post Intervention Results:

4.2.1 Discussion of Pre-Intervention Results

Before the intervention, the researcher carried out a series of interviews and observations about the state of the identified problem. Three different sets of unstructured interviews were carried out. One of the interviews was with the head teacher of the selected school. Findings from the interview revealed that most teachers do not use Dienes multi-based block resources in their mathematics lesson delivery and even the few that teach place value in math's lesson are not using Dienes multi-based block resources they depend largely on the pictures in pupil's text book, a few flip charts provided by GES and other NGOs and chalkboard illustrations. According to circuit supervisor, some usually state the Dienes multi-based block resources in their lessons but sometimes fail to discuss how to use them in the teacher learner activities column in their lesson plans. The C/S also added that a series of School-Based In-service Training have already been organised but Dienes multi-based block resources usage which forms one of the components for teaching and learning place value in mathematics has never be trained in that school.

The next interview was also with the six teachers. From their submissions, it was evident that most of them lack the spirit of using self-made materials (locally available materials) to support the few sophisticated materials available for teaching and learning. Some of them remarked that it is always time consuming and tedious to use Dienes multi-based block resources since lesson notes preparation is already spending much of their time. The final interview was for the circuit supervisor. The date settled for the circuit supervisors interview could not come off due to an equally assignment given to him by the District Director, different date was set for the interview.

According to him, there is always an emphasis on the use of Dienes multi-based block resources to support place value concept of teaching and learning during his regular monitoring and supervision to schools but some teachers failed to take the suggested ideas. He said plans have being made to organise training for teachers on the use Dienes multi-based block resources in relation to instruction of place value in mathematics any time there is funds.

Observation was also made in the classes to see how teachers deliver lessons in the classroom. Findings from the observation confirmed that some teachers actually teach using chalkboard illustrations and pictures from pupil's text books. Others teach using the lecture method which affects children understanding of concepts and ideas. It was only the basic six teacher who brought in a few bottle tops to the class but the use of it was not effective because of the poor class management. Hence, the researcher observed that teachers lack the skills of using Dienes multi-based block resources in teaching place value in mathematics prompted the researcher to organise the refresher training for primary teachers and circuit supervisor to enrich their skills of manipulating and handling of DMBs resources.

4.2.2 Discussion of Post-Intervention Results

After the intervention, the material was used by mathematics teachers to teach place value at the primary school. Lessons were observed on how to handle and manipulate DMBR place value lesson. Observation showed that pupil's participation was very encouraging and teachers used limited time to teach the concept of place value. Pupils were allowed to interact with the materials in groups and they were very happy when they solve simple addition using the material. Teachers were able to explain to pupils the components and how they function by feeling them with their hands. All the pupils were very quiet and engaged during the assembling of the

components on the table. After the lessons, an evaluation exercises were conducted in all the classes. Pupils were able to answer both oral and written question correctly. Hence, post-intervention showed that teachers have seen the significance of DMBR and the training has helped to develop teachers professionally and that has also been translated in the pupil's performance.

4.3 Challenges that Hindered the Effective Implementation of the Refresher Training.

Below are the challenges that hindered the effective implementation of the refresher training:

4.3.1 Time constrain

Timing affected the effective implementation of the training. The training was re-scheduled to take place in the afternoon instead of the morning since the head teacher did not want teachers to lose two days contact hours with pupils. Hence, this affected the smooth organisation of the training since some of the teachers have to take their children home after school before returning to the training venue which made them to report late.

4.3.2 Finance

Money for purchasing of materials and teachers refreshment was a challenge that hindered the effective implementation of the refresher training. Due to this limited funds, materials were not adequate since some of the materials have to be bought in the market. Their refreshment too was also inadequate due to inadequate funds.

4.3.3 Phone calls

Phone calls affected the training since some of the teachers were coming out to receive calls although all agreed to put all phones on silence. This attitude of some of the teachers affected the

smooth implementation of the training programme.

4.4 CONCLUSION

This chapter presented and discussed the demographic characteristics of respondents, the results of the pre-intervention, post intervention results and the pitfalls that hindered the effective implementation of the training. In conclusion, even though there was a considerable number of challenges but the study was successfully conducted and the set objectives achieved.

CHAPTER FIVE

SUMMARY, CONCLUTION AND RECOMMENDATIONS

5.0 INTRODUCTION

This chapter discusses the results obtained from chapter four. It presents detailed analysis of the results, conclusion and recommendations for the study in answering the research questions. It starts with the research questions, and then gives the conclusions based on the analysis from the results followed by the proposed recommendations.

5.1 SUMMARY OF THE FINDINGS

The research findings are based on the research objectives as follow:

5.1.1 Examine the uses of DMBs materials in basic mathematics

The first objective was to examine the uses of DMBs materials in relation to teaching mathematics at the basic level in Ghana Education Service. The data collected and analysed indicated that DMBs materials are appropriate teaching learning materials at basic level to enhance pupils' performance in mathematics.

Data analysis shows that 90% of respondents indicated that DMBs materials are use in almost all the topics in mathematics at the basic level and as such impact on the performance and productivity of teachers in Ghana Education Service (GES).

5.1.2 To train teachers on the use of DMBs materials to teach place value to basic six pupils

The study also revealed that, training of teachers does not only empower teacher performance but also help the teachers such as:

- It impacts teachers the requisite knowledge, skills on lesson delivery and classroom management techniques.
- It enhances effective and efficient lesson delivery.
- It helps teachers to upgrade to the current technological teaching and learning process.
- It equips teachers with proper way of handling and manipulating DMBs materials
- Training teachers helps to teacher -learner relationship in the classroom.
- It improves upon the professional competency and proficiency level of teachers in relationship to teaching place value.

5.3 CONCLUSION

This study was aimed at examining the impact of refresher training to teachers on the use of DMBs materials to teach place value to primary six pupils on their performance in mathematics. In conclusion, the findings of this study are:

The study discovers that some teachers teach place value without DMBs materials. Some teachers depend much on pictures in the curriculum materials only during instructional hours of mathematics. Enough TLMs for to mathematics are found in the immediate environment not only DMBs materials. The refresher training of teachers on DMBs materials is very good for all teachers since it remind them of what they already know but find it difficult to use the appropriate materials. The training gave teacher new ideas to teach using DMBs materials in handling place value operations. It helps mathematics teachers to build up confidence and sharpens their pedagogical skills in relation to handling and manipulating DMBs materials which enhance the overall performance in Education.

Refresher triaging to teachers on the use DMBs materials to place value is a continuous programme in Ghana Education Service and the staff are able to learn and update knowledge and skills when needed. However, the training programmes were had pitfall as, acquisition of funds, time allocated for the training hinders the systematic carried out of this planned programme.

5.4 RECOMMENDATIONS

From the summary and conclusion, the following recommendations are outlined for addressing the pitfalls identified and measures to improve training of teachers on the use of DMBs materials to teach place value in the basic level mathematics.

The Ghana education service (GES) should enforce by-laws to guide the implementation of school- based (SBI) and cluster-based in-service (CBI) training in our schools.

Supervision unit of the GES should be strengthened up by circuit supervisors to do proper monitoring and supervision.

Colleges of Education should infuse DMBs materials preparation and usage as a course in order to equip teachers with the skills of developing interactive materials for teaching and learning in schools, especially the basic school level.

Monitoring and supervision should be properly done to ensure that teachers use DMBs materials effectively to support mathematics lesson delivery in our schools. The researcher recommends that, all teachers at the basic level should be given refresher training on DMBs materials to teach place value to enhance their competency and increase performance of pupils. The Ghana Education Service should organise refresher training to teachers especially on TLMs preparation and usage. The districts training officers should organise training based on the needs of the

trainees not on huge funds to maximise profit. Guidelines for organising appropriate refresher for teachers in mathematics should be strictly followed.

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APPENDIX A

INTEVIEW SCHEDULE FOR MATHEMATICS TEACHERS

TRAINING TEACHERS ON THE USE OF DIENES MULTI-BASED BLOCKS TO TEACH BASIC SIX PUPILS PLACE VALUE AT NABULUGU D/A PRIMARY SCHOOL IN WEST MAMPRUSI DISTRICT.

This interview guide is designed to gather information from you as a participant. Information gathered from you will serve as the basis for devising an intervention, therefore, your participation remain anonymous and voluntary. All your responses will be kept completely confidential. As a prospective participant, you have the right to withdraw at any point of the exercise without having to give reasons.

Participant's number……. Date: ……

Please tick where is applicable and fill in the space that requires your comment

1. Gender male [ ] female [ ]
2. Age _____
3. Qualification Cert A/B [ ] DBE [ ] BED [ ] MASTERS [ ]
4. Rank

   Superintendent [ ] Senior superintendent II [ ] Principal Superintend [ ] ADII [ ] AD I [ ] others……
5. Years of experience: _____years

6. Years of teaching Mathematics. _____years

7. Do you use TLMs in teaching maths? Yes [ ] No [ ]

8. Which TLM do you use?

Dienes Multi-Base Block [ ] Pictures [ ] illustrations [ ] flip chart [ ] others (specify) ……

9. Have you ever been trained in how to use DMS block? Yes [ ] No [ ]

10. If yes, How long……..years.

11. Apart from Dienes Multi-base block, do you use other self made materials (locally available materials) to support the sophisticated ones? Yes [ ] No [ ]

12. If yes, Name any material used……

13. What account for the inability to use DMB?

Consume time [ ] tedious [ ] inability to use it [ ] others (specify)……

THANK YOU

APPENDIX B

INTEVIEW SCHEDULE FOR CIRCUIT SUPERVISOR

TRAINING TEACHERS ON THE USE OF DIENES MULTI-BASED BLOCKS TO TEACH BASIC SIX PUPILS PLACE VALUE AT NABULUGU D/A PRIMARY SCHOOL IN WEST MAMPRUSI DISTRICT.

This interview guide is designed to gather information from you as a participant. Information gathered from you will serve as the basis for devising an intervention, therefore, your participation remain anonymous and voluntary. All your responses will be kept completely confidential. As a prospective participant, you have the right to withdraw at any point of the exercise without having to give reasons.

Participant's number……. Date: ……

Please tick where is appropriate and fill in the space that requires your comment

1. Gender male [ ] female [ ]
2. Age _____
3. Qualification Cert A/B [ ] DBE [ ] BED [ ] MASTERS [ ]
4. Rank

   Superintendent [ ] Senior superintendent II [ ] Principal Superintend [ ] ADII [ ] AD I [ ] others……
5. Years of experience: _____years

6. Do you emphasise on the use of Dienes Multi-Base resources as TLM in teaching the concept of place value during monitoring and supervision?

   Yes [ ] No [ ]

7. How long do the emphasis lasted? _____years

8. What are the challenges hindering the use of DMB among teachers?

   ……

   ……

   ……

   ……

9. Do you prefer to emphasis on any other TLM in teaching the concept of place value apart from using the Dienes Multi-Base Block? Yes [ ] No[ ]

10. If yes, what is the other teaching resource suggested?

……

THANK YOU

APPENDIX C

OBSERVATION GUIDE

The researcher will observe and record behaviours but will not interact or participate in the life of the setting under study. It aims to explore the use of dienes multi-based blocks to teach basic six pupils place value at Nabulugu d/a primary school in West Mamprusi District**.**

Number of Client Observed:……...Date:…….

ASPECTS UNDER CONSIDERATION

Theme and Topic:…….

Objectives and learning outcomes of the Activity:…….

Comments:……

Instructions given:……

Type of activities:……

Presence of TLM/equipment:…….

Name of TLM/resource …….

Class size……

Role of teacher:……

Teaching strategies used:…….

Class interaction with TLM…….

Class interaction with teaching strategy/method……

Any other relevant observable comment:……..

……

……

……..