

UNIVERSITY FOR DEVELOPMENT STUDIES, GHANA

**USING INSERVICE TRAINING AS A CAPACITY BUILDING TOOL FOR JHS
MATHEMATICS TEACHERS TO IMPROVE PERFORMANCE: A CASE STUDY
OF DABOKPA CIRCUIT IN THE TAMALE METROPOLIS**

HUSSEIN BAHIJATU



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DABOKPA CIRCUIT IN THE TAMALE METROPOLIS

BY

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[UDS/MTD/ 0101/16]

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF EDUCATIONAL
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JANUARY, 2018



DECLARATION

Student's Declaration

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

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Supervisor's Declaration

I hereby declare that the preparation and presentation of the project work was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

Name: DR. HAJIA ALIMATU CECELIA ISSAKA

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Date.....



ABSTRACT

The purpose of this study was to employ an action research design using in-service training as a capacity building tools for JHS mathematics teachers to improve performance in the Dabokpa circuit of the Tamale Metropolis. The literature review was on the key themes raised in the research questions such as: the challenges facing mathematics teachers, the impact of INSET on mathematics teachers, and the strategies for teaching mathematics in basic schools.

Data obtained was analyzed using both quantitative and qualitative data analytical methods consisting of manual and SPSS software packages. The research designed in this study is Action research. The study Purposive sampling techniques were employed to select all 10 schools within the Dabokpa circuit and 21 mathematics teachers representing the sample size for the pre-intervention and post intervention stage of the study. The study employed the use of interview schedule, questionnaires and school records as data collection instruments.

Based on a situational analysis, an intervention in the form of in-service training was conducted to address the problems. The outcome of the investigation revealed that challenges facing mathematics teachers included; inadequate TLMs, curriculum overload, inadequate in structural time, poor pedagogy among others. At the intervention stage, strategies such as the use of technology (virtual classroom discussions), Teacher subject matter knowledge, the use of appropriate teaching and learning materials, cooperative learning, peer tutoring and use of symbolic representations in teaching mathematics in various schools within the circuit was encouraged. Analysis of the post intervention stage revealed that the intervention (INSET) was generally good. The interview revealed that mathematics teachers' usefulness in the schools has improved. The mathematics teachers were now able to teach topics that they



earlier perceived to be difficult during the pre-intervention stage. The mathematics teachers had improved in pedagogical skills after the intervention (INSET), cooperative learning and peer tutoring has been adopted by the teachers in teaching mathematics and performance has gradually improved on the part of both teachers and students.

It is recommended that government puts more effort in the training of mathematics teachers, reward mathematics teachers in a form of motivation (scholarship awarded to devoted teachers) and give high priority to the teaching of mathematics. GES and schools should organize more frequent and regular in-service training for the mathematics teachers, GES should do their possible best to supply adequate logistics on time, provide adequate teaching periods on time table among others to the schools within the circuit to improve quality teaching.



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DEDICATION

To my late mother for being the anchor of my strength, to my twin daddies; Yahaya Iddi Hassan and Hussein, my husband; Rufai Sufyan and my children; Muhammad Farkad Chentiwuni and Muhammed Fawaz Suglo and my in-laws especially Alhaji Rufai Mahama.



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LIST OF ACRONYMS AND ABBREVIATIONS

GES	-	Ghana Education Service
JHS	-	Junior High School
BECE	-	Basic Education Certificate Examination
SPSS	-	Statistical Package for Social Sciences

INSET	-	In-service Training
TLMs	-	Teaching and Learning Materials
WAEC	-	West Africa Examination Council
MAG	-	Mathematics Association of Ghana
PCK	-	Pedagogical Content Knowledge
PTPDM	-	Pre-Tertiary Teacher Professional Development and Management
SBI	-	School Based Inset
CBI	-	Circuit Based Inset
UNESCO	-	United Nations Educational, Scientific and Cultural Organization
MOE	-	Ministry of Education
DOE	-	Department of Education
UNISDR	-	United Nations International Strategy for Disaster Risk Reduction
DRR	-	Disaster Risk Reduction
OBE	-	Outcome Based Education
ZPD	-	Zone of Proximal Development



NCTAF	-	National Commission on teaching and America's Future
ACE	-	American Council of Education



CHAPTER ONE

ORIENTATION TO THE STUDY

1.0 OVERVIEW

This chapter focuses on the background of the study, statement of the problem, research question, objectives of the study, significance of the study, scope of the study and organization of the study.

1.1 BACKGROUND OF THE STUDY

In the United Kingdom, Castle (1971) wrote on the importance of teacher in-service training and development by highlighting that the mind of a teacher that goes on learning stays alive; the mind of the teacher who thinks he or she knows all is already dead. This statement implies that the teacher will remain a learner all his or her life.

He further added that, the quality of teaching and learning in any system of education of any nation will always be determined by the knowledge of the teachers who are key providers of education within the system. Therefore, the teacher must always know more than it is necessary for the students to know. Teachers ought to strive to enrich their minds with new knowledge and ideas so that their teaching can become more exciting and attractive. The training of mathematics teachers will help to strengthen them and improve their skills with the requisite mathematical knowledge and ideas to enable them facilitate the teaching of their students (Castle, 1971).

Regarding the importance of teacher improving on their subject knowledge through in-service training and questions surrounding how teachers teach in the classroom, Hammond, Darling



and Bransford (2005) claim it is not surprising that some mathematics teachers implement formative assessment without making substantive pedagogical changes, this authors raised some questions about teaching and which are: How do teachers learn to use their understanding of content matter, their practices and strategies to improve learning? How do they learn to keep balance between the diversity of learners and the needs of the curriculum? Hammond, Darling and Bransford (2005) further explain that in-service training therefore is aimed at imparting the fundamental knowledge about teaching on mathematics teachers and teacher education with a view to improve their performance.

In Nigeria, Ohunche and Obioma (1983) state that in assessing the level of readiness of basic school mathematics teacher to teach the mathematics subject, it was found that teachers perceived themselves as competent in numbers, numeration and basic operation but not competent and had inadequate knowledge in measurement, geometry and statistics. This issue of poor delivery calls for the need of inset training for mathematics teachers to improve performance.

In Ghanaian perspective, Essel, Badu, Owusu-Boateng and Saah (2005) opine that very educational process must have qualified teachers as a portion of the ingredients essential for the goals of the process to be measured and achieved. The teachers responsible for the process must equally be accorded a very high priority. Generally, it could be argued that the nature of the teaching profession makes it expedient and imperative for all teachers to engage in continuing career-long professional training.

Teachers should therefore be encouraged to participate in a wide range of informal and formal activities which will help them in processes of review, renewal, enhancement of thinking and practice and more especially, being committed both in mind and heart (Essel, et al.,2005).



With this in mind, there is therefore the need for all teachers to show commitment in their job and enthusiasm for continuing professional development (CPD). This is because CPD will assist all teachers to keep abreast of changes in their own countries and in other parts of the world (Essel, et al., 2005).

According to GES (2004) mathematics is given all the necessary importance in the curriculum and all policies related to education, right from primary to higher levels. In relation to that, the Ghana Education Service (GES) categorically stated that mathematics is one of the core or basic subject for all primary, Junior High and Senior High School children. In addition, mathematics is one of the compulsory subjects that must be passed at credit level by students before getting admission into any second cycle and tertiary institution in Ghana. It is therefore important that the content knowledge of mathematics teachers in the subject must be adequate and supported through in-service training.

It is upon this background that this study is aimed at using in-service training as a capacity tool for Junior High Schools (JHS) mathematics teachers to improve performance in the Dabokpa circuit of the Tamale Metropolis.

1.2 PERCEIVED PROBLEM

The way mathematics teachers handle classroom instruction and the recent student poor performance in external examination, BECE are strong indication that the teaching and learning of mathematics is not effectively done in schools. It is quite apparent that, students' low performance was as a result of apathy on the part of the mathematics teachers' classroom instruction strategies used in the schools. In respect of this fact that students at the basic level seem to have below average grades in mathematics which makes their results bloated up to



higher grades. It was also revealed that, mathematics teachers do not apply the appropriate teaching methodologies, and this in tend creates difficult situation for students to pass the mathematics subject in external examination organized by West African Examination Council (WAEC), especially at the BECE level. The problem of low performance among students and their inability to acquire good grades in mathematics was identified by the researcher in the results of schools in pupils' performance in recent years in the Dabokpa circuit of the Tamale Metropolis.

1.3 DIAGNOSING THE PROBLEM

According to the Mathematics Association of Ghana (MAG, 2017), some mathematics teachers do not use current curriculum and text books to teach the subject. MAG (2017), recently identified confusion in text books causing students to fail in mathematics. Mathematics teachers who were willing complained of limited time to finish syllabus in the subject before the external examination and the way mathematics teachers handle classroom instruction and the recent student poor performance in external examination, (BECE) are strong indication that the teaching and learning of mathematics is not effectively done in schools. This therefore points to the fact that most teachers are unable to efficiently apply Pedagogical Content Knowledge (PCK) in the mathematics subject. Also students as the basic level poor performance in subsequent BECE examinations can be attributed to mathematics teachers' lackadaisical attitude towards teaching the mathematics subject. The researcher therefore seeks to embark on this study to bring to weight how to use in-service training (INSET) as a capacity building tool to enhance and develop the teaching skills of mathematics teachers in the Dabokpa circuit of the Tamale Metropolis.



1.3.1 Evidence of the Problem

The researcher's awareness of the problem is the trends in the passes rate in mathematics in the BECE examination from 2012 to 2017. Looking at the overall trends in BECE results of the Metropolis which Dabokpa is one of the circuits, there is a clear indication that pupils of basic schools do not pass in mathematics subject which is a core subject and a requirement to good grades. When mathematics problems persist even if additional support is given, it becomes imperative to undertake research that will lead to a solution of the problems. Statistics from the Tamale Metropolitan Directorate of Education also indicate a declining rate in performance of overall performance in BECE trending from 2012 to 2017.

TABLE 1.1 BECE ANALYSIS OF MATHEMATICS SUBJECT FOR DABOKPA CIRCUIT

YEAR	TOTAL CANDIDATES REGISTERED			No OF CANDIDATES OBTAINING GRADE. 3-5			No OF CANDIDATES OBTAINING GRADE 6-9		
	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL
2017	214	98	312	99	20	119	115	78	193
2016	293	198	491	68	21	89	225	177	402
2015	334	227	561	84	41	125	250	186	436
2014	246	338	584	120	52	172	126	286	412
2013	311	304	615	142	90	232	169	214	383
2012	392	231	623	92	43	135	300	188	488

Source: Tamale Metropolitan Directorate of Education



The table above shows trend of BECE mathematics results for eight schools. The other two schools namely Subahiya M/A JSS and Monawara M/A JHS are yet to register their candidates in 2018 since these two schools are newly established and have no BECE records.

The table indicates that total candidates registered has majority being boys for all the trend of years. There is a descending order in the total of candidates registered ranging from 623 in 2012 to 312 in 2017. Indicating that there is a decline in the number of candidates registered to take BECE Examination in the trend of the years. Total numbers of candidates with grades 6-9 are more than candidates with grade 3-5 with girls having more grades in 6-9 in respect of the total for girl candidates. For instance, in 2017 the total number of girls registered was 98 and 78 candidates fell between grades 6-9 indicating a fail since these grades ends up bloating up their results to higher aggregates'. This clearly shows that, most of the candidates who obtain grades 6-9 are mostly girls because it's believed that girls perceived mathematics to be a difficult subject. The total numbers of candidates falling between grades 6-9 evidently indicates low performance in the mathematics subject. Majority of the candidates fall between grade 6-9 making their results bloated up and hence poor performance of the Dabokpa circuit. This further concludes that students of Dabokpa Circuit greatly fall within grades 6-9 in mathematics in the BECE analysis of schools within the circuit resulting into poor performance of the circuit.

With regards to the evidence above, the researcher therefore seeks to embark on this study to bring to light, how to use in-service training (INSET) as a capacity building tool to enhance and develop the teaching skills of mathematics teachers in the Dabokpa circuit of the Tamale Metropolis.



1.3.2 Causes

To identify the causes of the problem, the researcher conducted an interview, administered questionnaire and analyzed documents which revealed the poor performance in the mathematics subject in the BECE examination.

Through the interview, the researcher found that the poor performance in mathematics may have different causes.

Mathematics teachers complained of limited time to finish syllabus in the subject before the external examination, inadequate teaching and learning materials (TLM) and most teachers are unable to efficiently apply Pedagogical Content Knowledge (PCK) in the mathematics subject. Also students at the basic level's poor performance in subsequent BECE examinations can be attributed to mathematics teachers' lackadaisical attitude towards teaching the mathematics subject.

1.4 STATEMENT OF PROBLEM

The quality of education cannot be separated from the goal of universal primary education. The governments' frantic effort to improve on accessibility and quality of education to all basic school children and the standardized nature of assessment of the (BECE) for terminal stage of the basic school puts schools and educational authorities under pressure regarding pupils' performance in the examination.

The way mathematics teachers handle classroom instruction and the recent student poor performance in external examination, (BECE) are strong indication that the teaching and



learning of mathematics is not effectively done in schools. Students at the basic level seem to have below average grades in mathematics which makes their results bloated up to higher grades. BECE results of schools in pupils' performance in recent years in the Dabokpa circuit of the Tamale Metropolis leaves much to be desired.

The school mapping report of Tamale metropolis (2012) states that performance quality of candidates presented for the past six years shows a declining trend. The report added that the proportion of candidates with aggregates more than 31 keep on rising; thus rendering them unqualified for admission into second cycle institutions as demanded by the education policy in Ghana. One of the subjects that contribute to the declining pass rate is the mathematics subject and the way it is taught in the classroom. There are questions about the quality of training teachers who teach the mathematics subject have undergone.

This therefore calls for the assessment of what goes on in the classroom, the kind of in-service training that should be given to mathematics teachers, what teachers are expected to do in terms and how to increase students pass rate in the subject.

In the light of the above, the research seeks to find out why there is an abysmal performance in mathematics and how to use in-service training (INSET) as a capacity building tool to enhance and develop the teaching skills of mathematics teachers in the Dabokpa circuit of the Tamale Metropolis.

1.5 PURPOSE OF THE STUDY

This study was intended to access and to describe how to use in-service training as a capacity building tool for JHS mathematics teachers to improve performance in Dabokpa circuit of the Tamale Metropolis. The study was specifically focused on the following two major variables:



- Using in-service training such as workshop
- Improving mathematic teachers' performance.

The aim of the study was to identify the challenges facing mathematics teachers so as to be able to examine the impact of in-service training on the mathematics teachers as well as use effective strategies in teaching of mathematics at the basic schools.

1.6 OBJECTIVES OF THE STUDY

The study achieved the following objectives:

1. To determine the challenges facing mathematics Teachers in the Dabokpa circuit.
2. To examine the impact of in-service training on mathematics teachers.
3. To explore effective strategies for teaching mathematics.

1.7 RESEARCH QUESTIONS

The study answered the following questions:

1. What are the challenges facing mathematics teachers?
2. What is the impact of in-service training on mathematics teachers?
3. Which teaching strategies are effective for teaching mathematics?

1.8 SIGNIFICANCE OF THE STUDY

The findings of this study provide insight into how to organize in-service education for mathematics teachers. The findings will suggest some useful and effective strategies for teaching mathematics.



In addition, researchers on the same topic or any similar topics could use the results of the study to design their own studies. Moreover, donors who wish to support the development of JHS education in the Dabokpa circuit within the Tamale Metropolis would be guided.

1.9 SCOPE OF THE STUDY (DELIMITATION)

Even though, teachers within the Dabokpa circuit face many challenges in the various subjects. This study focused on the use of INSET as a capacity building tool for only JHS mathematics teachers to improve performance. The challenges as identified is wide spreading within the Metropolis, however, this study only considered the Dabokpa circuit in the Tamale Metropolis. The Dabokpa circuit is one of the many circuits situated within the Tamale Metropolis.

1.10 ORGANIZATION OF THE STUDY

The study is in five (5) chapters; Chapter one (1): consists of introduction, background of the study, problem statement, objectives of the study, research questions, significance of the study, scope of the study (delimitations), limitations of the study, organization of the study and conclusion. Chapter two (2): consists of literature review including the introduction, conceptual analysis, factors under investigation and theoretical framework of the study. Chapter three (3): consists of the methodology of the study which will include the introduction, profile of the study, research approach, research design, population of the study, sampling and sampling techniques, research instruments, data type and sources, situational analysis, intervention, post intervention, validity and reliability and data collection procedure. Chapter four (4): consists of the results and discussion of the study including introduction, demographical characteristics of respondents, situational analysis (pre-intervention), the



intervention, post intervention and challenges hindering the effective implementation of programs and Chapter five (5): constitutes the summary, conclusions and recommendations including introduction, conclusion and recommendation.

1.11 CONCLUSION

This chapter focused on the background of the study, statement of the problem, research question, objectives of the study, significance of the study, scope of the study and organization of the study.



CHAPTER TWO

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter presents the literature reviewed for the study. The area covered are: the conceptual framework, the theoretical framework and the review of literature on the key themes raised in the research questions such as: the challenges facing mathematics teachers, the impact of INSET on mathematics teachers, and the strategies for teaching mathematics in basic schools.

2.1 CONCEPTUAL ANALYSIS

The conceptual analysis of this study looks into the concept of in-service training, GES Nationwide INSET programme, Pre-Tertiary Teacher Professional Development and Management (PTPDM) policy, Pre in-service Teacher Training, In-service Education and Training (INSET) for Mathematics Teachers, Importance of In-service, Capacity building and Academic Performances.

2.1.1 The concept of In-Service Training

The need for in-service training in schools is receiving more consideration for teachers to be equipped with new knowledge and skills for them to face new challenges and restructuring in education.



In-service training is defined as the process whereby the effectiveness of teachers collectively or individually is enhanced in response to new knowledge, new ideas and changing circumstances in order to improve, directly the quality of pupils' education (Zulkifli, 2014).

Day (1993) also defines In-service Training as consisting of all natural learning experiences and those conscious and planned activities which are intended to be of direct or indirect benefit to the individual, group or school which contributes to the quality of education in the classroom.

In-service Training can be defined as the variety of activities and practices in which teachers become involved in order to enrich their knowledge, improve their skills in teaching and also enable them to become more efficient on the job (module 3, SBI/CBI manual, p. 3). In-Service education Training (INSET) has been considered as essential to the maintenance and sustaining the capacity of the teacher to continue to provide quality teaching and learning in the classroom.

According to the GES manual on SBI/CBI states that, the effectiveness of in-service training in school is also related to the attitude of teachers in school. Teachers should have a positive attitude towards in-service training organized by their school. Teacher's attitude towards teaching philosophy, in-service training and educational reform can influence their response towards training that is conducted. Where attitude is defined as the reflections of teachers' beliefs and opinions that support or inhibit their teaching behavior (Omar, 2014 p.5).

Lockeed and Verspoor (1991) states that, competencies needed to be able to perform well in the classroom by teachers must not be allowed to remain static, as teachers must always keep



pace with changing trends in teaching strategies and curriculum reforms through in-service training.

The provision of in-service training of teachers should thus be continuous. SBI/CBI offers teachers the opportunity to improve their own competencies continuously based on their daily teaching activities and experiences at the classroom level and through the sharing of ideas with colleague teachers.

2.1.2 GES Nationwide INSET Programme

The nationwide In-Service Education and Training (INSET) programme of the Ghana Education Service (GES) aims at developing an institutionalized structure and replicable INSET model for Pre-Tertiary institutions in all subjects in the 216 districts. The programme has been sensitizing teachers and other stakeholders on the problem and intervention strategies in the teaching of Mathematics, science, language and literacy (GES newsletter 10th edition, March 2015 p. 1).

2.1.3 Pre-Tertiary Teacher Professional Development and Management (PTPDM)

policy

In Ghana, PTPDM stands for Pre-Tertiary Teacher Professional Development and Management (PTPDM). As the name implies, its focus is on issues that are related to teacher development and management of pre-tertiary teacher.

The goals of the PTPDM policy include the following:



1. Providing the frame work for developing standards, core values and ethics for the teaching profession in order to foster the development of a world class teacher capable of contributing significantly to student learning and achievement
2. Develop teachers' ability to adopt reflective teaching approaches to enhance the quality of lesson in Kindergarten, Primary, Junior High, Senior High and Technical and Vocational Institutions.
3. Specifying principles for teacher management in order to motivate excellence in teacher performance and commitment to lifelong learning and many others (GES newsletter 10th edition, March 2015 p.1)

2.1.4 Pre-service Teacher Training

Pre-service training is usually provided at the teacher training colleges; where the student teacher is introduced to the knowledge and skills needed to do a professional job in teaching (Farrant, 2004). During pre-service training the student is introduced to the principles that underlie teaching such as the aims of education, the curriculum, the nature and characteristics of child development, methods of learning and teaching and teaching and learning resources.

The key role of a teacher is that he or she should be a facilitator of learning and an agent of change. It is therefore crucial that the teacher be well prepared in order to make him or her carry out the necessary roles effectively. Pre-service training may provide the mathematics teachers (and teachers of other core subjects) the competencies they need to make them perform the facilitator's role.

According to Farrant (2004) pre-service training nearly always introduces the student teacher to the practical work of actual teaching in a school but it is no more than an initiation. This



initial training the teacher trainee receives cannot fully prepare him or her to teach for life. This is because the skills, knowledge and competencies he or she has acquired during the pre-service training are not enough (Farrant, 2004).

Farrant (2004) further states that, there seems to be an explosion of knowledge taking place in the world. Besides this explosion of knowledge, the skills and knowledge the teacher gain from an initial training may start to diminish with time. This is so when he or she is isolated from reading materials or libraries to keep him or her informed about latest developments in education. Sometimes there are changes in curricula of the schools and the methodology that goes along with these changes. Therefore, there is need for the teachers to update their skills and knowledge to match with current developments in education through in-service training.

2.1.5 In-service Education and Training (INSET) for Mathematics Teachers

Farrant (2004) defines in-service education and training (INSET) as a lifelong process in which the teacher is constantly learning and adapting to the new challenges of his or her job. Much of this training, according to Farrant (2004) is self-directed and is carried out by reading books and articles on education, by discussing with colleagues and supervisors' matters concerning teaching and by attending courses and conferences on education. UNESCO (as cited in Adentwi, 2002) indicates that in-service training is training designed for teachers who are already in professional practice and which they receive in the context of or during period of varying length when their normal duties are suspended.

Adentwi (2002) observes that the concepts of INSET underscore the need for all professional people to strive to acquire, on continuous basis, new ideas, skills, and attitudes to enhance their competencies and productivity and to effectively cope with inevitable changes that occur



in the world of work. In-service training is accepted as an effective method of increasing the knowledge, skills and positive beliefs of teachers. It is a process used to continue the teachers' education once they have received their certifications in teaching and are employed in a professional position (Locke, 1984). From these definitions, in-service education and training (INSET) is intended to help and support the professional development and growth that teachers should experience throughout their work as teachers.

Jackson (1982) asserts that the provision of opportunities for upgrading and continued professional growth of the teachers in Ghana is one way to improve the educational system in the country. Also, the Ministry of Education (education act, 2008) indicates that Ghana's National Policy on Education and Training supports the conduct of in-service education and training (INSET) in the country. It specifically recommended that MOE should conduct annual refresher courses for teachers of mathematics, science, and English Language.

Also, with regards to in-service training for teachers, according to Darling-Hammond (1999) investment in teachers' knowledge and skills net greater increases in students' achievement (in the US) than other uses of an education dollar. Loucks-Horsely and Matsumoto (1999) attest that teachers' professional development has great impact on improving performance in mathematics. They indicate student learning is however not measured frequently enough when evaluating the impact of teachers' professional development. Borko and Putnam (1995) also assert that inset training for the teacher plays a vital role in changing teaching methods, and that these changes have positive impact on improving performance.

INSET, in its most strict definition of courses for on-the-job learning, has also received a number of criticisms in the literature. Sharma (1992) declares that in most part of the world, the majority of in-service education and training programmes are too short, too unrelated to



the needs of the teachers, and too ineffective to upgrade teaching knowledge. Moreover, INSET courses are theory-oriented and do not address practical concerns of the participants. Furthermore, educators in charge of in-service courses are poorly prepared. Additionally, there are few reading materials related to the field available to the teachers.

Sharma (1992) in the criticisms about INSET activities does not state how the concerns listed could be adequately addressed in order to improve students 'achievement through empowering the teachers. However, with reference to the criticisms about the INSET activities, the present researcher declares that INSET should be well planned, be given adequate time, courses should be more practical, very competent and adequately prepared mathematics educators should be in charge of INSET programmes planned for teachers teaching mathematics.

2.1.6 Importance of In-service training

According to Ekpoh, Oswald and Victoria, (2013) asserts that the importance of in-service training shows that teachers who attend in-service training perform effectively in work regarding knowledge of the subject, classroom management, teaching methods and assessment of students. In the studies of Jahangir, Saheen and Kazmi (2012), they established that in-service training plays a major role in improving teachers' performance in schools. In line with the above, Ronald (2004) acknowledged the importance of in-service training as a 'result-driven training concerned with changing behavior and/or attitudes of teachers, administrators' and staff members rather than being concerned with the number of participants in such a programme' (p. 169). He further on stated that, it is accurately impossible today for any individual to take on a job or enter a profession and remain in without any changes. Hence



in service training is not only necessary but also about an action to which each school system must commit human and fiscal resources if it is to retain a skilled and knowledgeable staff'.

In a related study, Thompson (1992) found that after going through in-service training, there are positive changes in teachers' attitude, increase self-confidence and also follow up with teachers' preparedness in facing various confrontational situation. This shows that, training program that is planned and implemented well will give a positive effect on students, teachers and schools.

According to Davis-Kahl and Payne (2003), with regards to the importance on in-service training claims that today's teachers training and lifelong learning are considered as some of the most important parameter for school efficacy as well as for the renewing and reforming of the teaching systems.

In-service training must be proactive rather than reactive and its effectiveness depends on the extent to which it is tailored and based on positive ideas. On this part, in-service training in schools requires strong leadership. In line with this, Ong (1993) writes that, the responsibility is assigned to administrators because they have ready access to data that provides a picture-perfect of strengths and weaknesses of the individual staff members, the feeble area of curriculum, and how their school measure up to Ministry of Education's goals and objectives (Ong, 1993).

In respect to measuring up to the goals and objectives of MoE, there is the need for heads of schools to be committed in identifying the training needs for teachers and preparing a suitable training based on their needs (Lee 2005). There is however the need for capacity building to



improve and update the quality of the existing teaching force, and also to ensure that teacher programmes integrate content, pedagogy, subject matter and technology (Hughes, 2005).

2.1.7 Capacity Building

According to United Nations Development Planning UNDP: in the globally context, capacity building refers to the ability of individuals and institutions to make and implement decisions and perform functions in an effective, efficient and sustainable manner. At the individual level, capacity building refers to the process of changing attitudes and behaviors imparting knowledge and developing skills while maximizing the benefits of participation, knowledge exchange and ownership. At the institutional level focuses on the overall organizational performance and functioning capabilities, as well as the ability of an organization to adapt to change.

Source: [www.vliz.be/wiki/the concept of capability building by Vlaams institute Voor de zee, platform Voor Marien Onderzoek DA:10/5/2017](http://www.vliz.be/wiki/the%20concept%20of%20capability%20building%20by%20Vlaams%20institute%20Voor%20de%20zee,%20platform%20Voor%20Marien%20Onderzoek). With regards to the definition of capacity building, the United Nations International Strategy For Disaster Reduction (UNISDR) defines capacity building or capacity development in the Disaster Risk Reduction (DRR) domain as the process by which people, organizations and society systematically stimulate and develop their capabilities over time to achieve social and economic goals, including through improvement of knowledge, skills, systems and institutions within a wider social and cultural enabling environment.

The World Bank – African Region defines capacity as the proven ability of key actors in a society to achieve socio-economic goals on their own. This is demonstrated through the functional presence of a combination of most of the following factors: viable institutions and

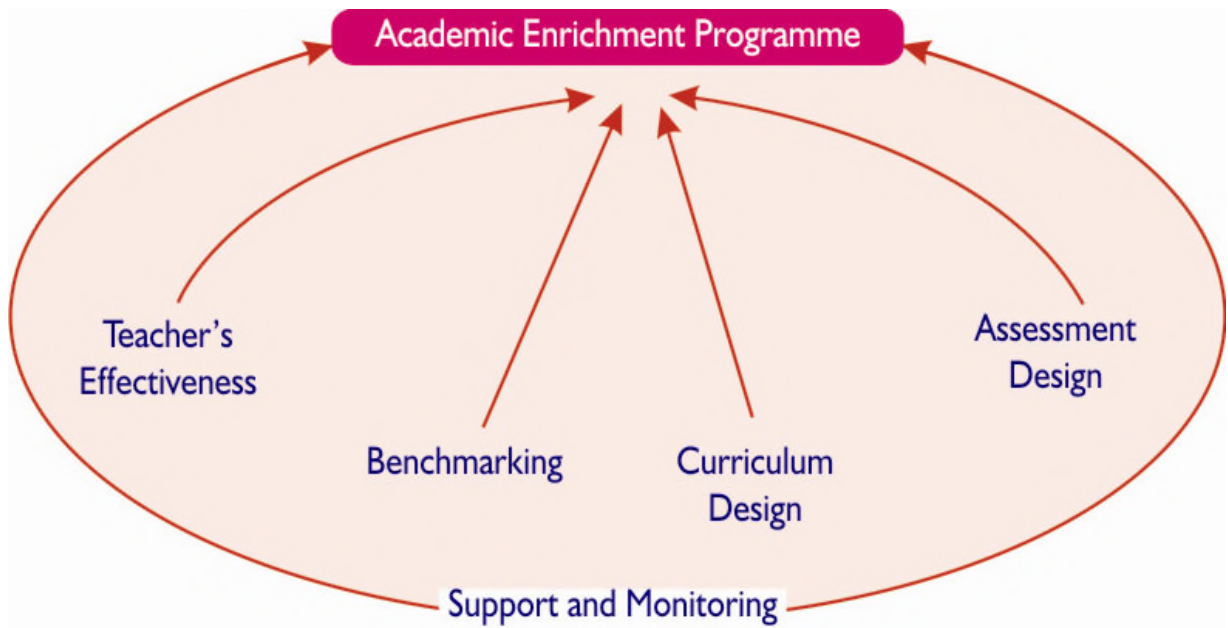


respective organization; commitment and vision of leadership; financial and material resources; skilled human resources.

2.1.8 Academic Performances

According to Wikipedia, academic performance is the extent to which a student, teacher/institution has achieved their short/long term educational goals. It is measured commonly through examinations or constant assessments. The academic performance index is used to measure of academic performance in schools by departments of education.

Figure: 2.1 Academic Enrichment Programme (AEP)



The focus of the study is on holistic improvement of student and teacher performance in schools.

Quality benchmarking for the school is conducted as a first step, to provide basis for improving school effectiveness, followed by Teacher Training Interventions through the academic year. Modifying teaching approaches in core subjects. Teachers make this change



using a framework known as “Understanding by Design”. The programme includes sessions clarifying the new approach, making worksheets and assessments to suit the new approach, demo lessons, giving feedback for improvement after extensive observation of teachers in the classroom, etc.

The academic enrichment programme helps in the capacity of teachers through workshops in the provision of skills based curriculum and assessment. Subject workshop especially in mathematics helps teachers understand the learning objectives and its motivates teachers to reflect on the importance of making learning applicable, identifying new trends in mathematics teaching, handling difficult topics in mathematics and hands on mathematics.

2.2 THEORETICAL FRAMEWORK

The theoretical framework that underpins this study is the *constructivist approach* and the importance of constructivist theory in teaching and learning. The propounding scholars of the constructivist theory includes Dewey (1933/1998) who is often cited as the philosophical founder of this approach; Piaget (1972) and Bruner (1915-2001) are considered chief theorists among the cognitive constructivists, while Vygotsky (1978) is the major theorist among the social constructivists, Simon (1915-2016) among others.

By 1980s the research of Dewey and Vygotsky had blended with Piaget’s work in developmental psychology into the broad approach of constructivism being that students learn by doing rather than observing. Students bring previous knowledge into learning situation in which they must analysis and re-evaluate is repeated until they can exhibit their understanding of the subject.



The aim of using constructivism theory in this study is to understand how teachers teach children to actively construct new ideas and derives meaning from them. This also implies that the child should be able to explain what he has learnt or to be able to practically apply the knowledge gained. For example, the child should be able to use the knowledge gained in a lesson on addition to count the number of items such as marbles available to him. The theories that influence the way mathematics should be taught are discussed below.

A constructive theory places the child in a much more active role in the learning. Learning is not “swallowed whole” but it is modified and transformed based on the child’s cognitive structures, social interaction, previous learning, and environment. Interaction with, and manipulation of, mathematical programmes is seen as critical to the development of mathematical knowledge, which is in the state of development and modification (Kutz, 1991:10).

Donald, Lazarus and Lolwana, (2010:81) contend that constructivism is a view of knowledge as being actively constructed (by individuals, groups and societies), not simply transferred. The scholars further state that it constitutes the interest and the will to achieve, or to take on anything. Constructivism sees human beings “as active agents in their own learning”. The idea is that knowledge is not flaccidly received but vigorously constructed. Through engaging in experiences, activities, and discussions which challenge the children to make meaning of their social and physical environment, children are actively engaged in building a gradually more complex understanding of their world. (Donald et al., 2010:80 and Schunk, 2004:286).

For Moodley, Njisane and Presmeg (1992:26) explain that within constructivism “We see what we understand rather than understand what we see. Man’s drawings of reality and



understandings of situations reflect the internal organization of his network of ideas.” Thus the scholar’s advice on following objectives when discussing constructivism:

- To discuss different kinds of learning
- To show the way we learn is also determined by the kind of knowledge we know
- To indicate alternatives to the usual one-way communication from teacher to child
- To show that meaningful learning takes place if children are given an opportunity to:

- (a) Use manipulative in the acquisition of new ideas,
- (b) Read and write freely about what they are learning or have learnt,
- (c) Speak to the teacher about new ideas,
- (d) Construct their own knowledge through acting out, writing or describing their understanding,
- (e) Show that it is in the nature of thinking that misconceptions arise,
- (f) Show the new role of teaching is that of facilitating the child’s construction of his knowledge,
- (g) Indicate a new avenue of evaluating learning through interviews and the use of physical media.

The above discussions are pertinent for this study and do concur with how teaching and learning of mathematics are envisions for the South African children as embraced in the curriculum. As a result, the researcher in this study agrees with Moodley et al., (1992:36) about the following:



- Constructivism emphasizes the active role of the child in constructing knowledge. The fact that the mind constructs knowledge means that our understanding will be limited by our perceptions. It is no wonder that children have misconceptions in mathematics, which are highly resistant to teaching. In order to replace misconceptions, we need to construct a new knowledge that is commensurate with our experience.
- Constructivism encourages dialogue between the child and the teacher with a view to providing an opportunity for the child to construct his knowledge. Emphasis is placed on the importance of a two-directional flow of information between the teacher and children. Through this dialogue, real communication may take place.
- The role of the teacher is to listen to the children and accept what they say and try to understand what they are doing in an atmosphere of emotional and psychological safety. Teaching also has to nurture and promote the formation of more effective and adequate constructions.
- A different approach to teaching have to be blended with the constructive ones, as it is only then that the teacher can appreciate children's difficulties and the manner in which they interact with a given field of knowledge. As has already been noted, constructivism demands that teachers shift from "telling" children, to negotiating meaning with children.

Van de Walle (2006:4) states that constructivism suggests that we cannot teach children by telling. Rather, we must help them to construct their own ideas by using what they already know. In this regard, children are not left alone hoping that they will luckily discover new numerical ideas. On the contrary, the teacher's conduct when teaching the class plays an enormous role in what is learned and how well it is understood.



Van de Walle (2006:4) adds the following three factors that influence learning: learners reflect thinking, social interaction with other children in the classroom and Use of programmes or tools for learning (manipulative, symbolism, computer tools, drawings, and even oral language).

2.2.1 Learner's reflective thinking

Constructive theory, encouraged children's reflective thinking. For a new idea to be interlocked in a rich web of interrelated ideas children must be mentally engaged. They must find the relevant ideas they possess and bring them to bear on the development of the new idea. For example, children can share and explain how they arrive at the answer.

2.2.2 Social interaction with other children in the classroom

Reflective thought and learning are enhanced when the child is engaged with others working on the same ideas. An environment is needed in which children share ideas and results, compare and evaluate strategies, challenge results, determine the validity of answers, and negotiate ideas on which all can agree. Vygotsky (1978) focused on social interaction as the key component in the development of knowledge. For example, children learn more easily when they learn from their peers and when they are not afraid to ask questions.

2.2.3 Use of programmes or tools for learning (manipulative, symbolism, computer tools, drawings, and even oral language).

The theory of Piaget, Dienes, Freud and Bruner argues on the role of manipulative materials in the teaching mathematics. It should not be surprising that current research has established a substantial relationship between the use of manipulative materials and student achievements.

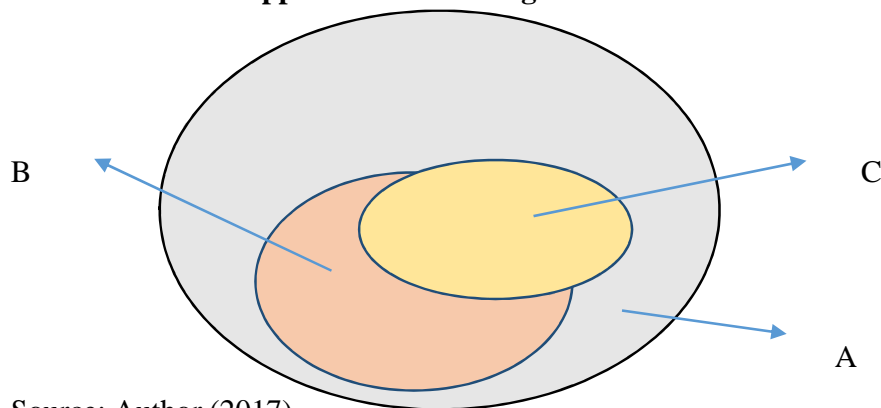


According to Piaget (1971) suggest that concepts are formed by children through reconstruction of reality, not through an imitation of it; Bruner (1960) indicated that knowing is process, not a product; and Dienes (1969), whose work specifically relates to mathematics instruction; suggest that children need to build or construct their own concept's from within rather than having those concepts imposed upon them.

Hiebert (1997) argues that the concept of this programme should be expanded to include oral language, written symbols for mathematics, and any other tools that can help children think about mathematics. For example, the automatic constant feature of a calculator can assist children in the development of skip counting and pattern recognition.

Researchers in mathematics education are still in the process of accumulating a persuasive body of evidence that supports the use of manipulative materials in mathematics.

Figure 2.2 Constructive Approach to Learning



Source: Author (2017).

Keys

A: Learners Reflective Thinking

B: Social Interaction with Other Children in the Classroom



C: The Use of Programmes/ Tools

A: shows how children are encouraged to reflect on new and relevant ideas that must be mentally engaged. B: enhances the child's ideas which are engaged with others. Vygotsky (1978) focused on social interaction as a key component in the development of knowledge.

C: The uses of programmes or tools for learning according to Piaget suggest that, concepts are formed by children through reconstruction of reality, not through an imitation of it. The approaches of the proponents of both OBE and constructivism to learning stress that children should be viewed as the central point in the learning process. Children should take the initiative in constructing their own understanding of numerical concepts that will allow them to handle numerical activities with full confidence (DoE, 2003:8).

Such children will be able to use numerical tools to solve problems. Van de Walle (2007:13) also claims that the layout of a reformed numerical environment designed with concrete objects will encourage children to engage in practical activities. According to Van de Walle (2007:30), the classroom environment that is well matched to the theory of constructivism should be characterized by children having their own ideas, realization and sharing with others.

The diagram presented in figure 3 indicates that, both social interaction with children and the use of programmes or tools for learning are seen in a learner's reflective thinking, while the social interaction with other children and the use of programmes are interrelated. Hence 1, 2 and 3 are all dependent on each other for a child's improvement in learning.



2.2.4 Constructivism and understanding of cognitive development in children

One of the scholars within the constructivism theory is Vygotsky (1978). Vygotsky has helped us to understand that the development of cognition in the young, and the social construction of knowledge itself are related processes. Both involve the construction and transmission of values, information, and ways of understanding through processes of social interaction (Donald et al., 2010:81). Furthermore, Vygotsky (1978) stresses the role of the mediator in the developmental construction of knowledge. His concept of the Zone of Proximal Development (ZPD) incorporates the notion of active agency on the part of the child. He helps us to understand that knowledge in general is not passively received (Donald et al., 2010:80). Thus children provide feedback orally or through written work. It is necessary only to show how the constructivist beliefs can be used by teachers and those that will prove that children understand effectively.

With regards to Slavin, (2009) the child's thoughts are related exclusively to concrete and actual things, but they cannot reason abstractly and also points out that the child can form concepts, see relationships, and solve problems, but only as long as they involve objects and situations that are familiar (Slavin, 2009).

2.2.5 The influence of constructivism in learning

Van de Walle (2007:28) alleges that the theory of constructivism suggests that teaching does not imply transferring information to children. Furthermore, he explains that learning is also not a process of passive swallowing of information from books or teachers. He contends that children construct meaning themselves when the teaching and learning process is based on an



interactive classroom situation in which children are actively engaged in learning (Van de Walle, 2007:39).

In active learning, the children handle concrete objects to better understand and gain knowledge. The children will also use their own words to explain the information gained from their commitment with the situation. In this manner children are given the opportunity to develop the acquired knowledge and understanding through active learning. By discussing their actions and how they solve the problems, their numerical knowledge is enhanced (DoE, 2003:65).

Van de Walle (2007:6) notes that, in contrast to the traditional classroom, constructivism advocates interaction in the classroom where children are actively engaged in the process of constructing numerical knowledge and understanding. This is in line with Outcome Based Education (OBE) aims and constructivism methods.

The Outcomes-Based Education (OBE) and constructivism methods form the basis of the numerical curriculum (DoE, 2003:1).

The approaches of the proponents of both OBE and constructivism to learning stress that children should be viewed as the central point in the learning process. Children should take the initiative in constructing their own understanding of numerical concepts that will allow them to handle numerical activities with full confidence (DoE, 2003:8).

Such children will be able to use numerical tools to solve problems. Van de Walle (2007:13) also claims that the layout of a reformed numerical environment designed with concrete objects will encourage children to engage in practical activities. According to Van de Walle (2007:30), the classroom environment that is well matched to the theory of constructivism



should be characterized by children having their own ideas, realization and sharing with others, respect for the ideas of others, realization that mistakes are an opportunity for growth as they are uncovered and explained, and coming to understand that mathematics makes sense.

Van de Walle (2007:14) argues that in the constructivism mathematics class, teachers encourage children to “work in groups, in pairs or individually” to share numerical ideas. As they reason and explain, they understand numerical concepts and improve performance in mathematics.

Whitin and Whitin (2006:200) argue that, teachers who believe that language is an important learning tool that helps children to communicate numerically and construct their own understanding of numerical concepts, use group work and pair investigation in the classroom. They further allege that the report back sessions provide children with the chance to discuss their tasks and their involvement in them. These feedback sessions also give children the opportunity for practical involvement and thus a chance to gain confidence.

According to the Professional Standards for Teaching Mathematics, as presumed by Van de Walle (2007:5), teachers must make a shift from a teacher centered to child centered approach in the teaching of mathematics.

They further claim that child centered classes refer to classroom practices and activities that focus on the involvement of children. The principles of constructivism classrooms Van de Walle (2007:14) claim that the practice of active participation in learning activities is an effective way for children to understand numerical concepts.

This is consistent with how Ghanaian teachers are expected to teach. Their roles include facilitation, mediation and support of learning. As facilitators they should always view



learners as active participants in the learning process. Should learners experience barriers in this process, teachers are expected to mediate through learning support processes.

The above discussion is relevant for the teaching and learning of mathematics within the constructive and cognitive theory.

Illeris (2004) and Ormrod (1995), explain teaching and learning as a process that involves the emotional, cognitive and environmental influences and experiences for gaining, enhancing, or making changes in a person's values, skills, knowledge, and world views. A learning theory is away to explain how animals and human beings learn, thereby helping to understand the inherently complex process of learning.

Learning theories have two main values, according to Hill (2002). On the one hand, they provide us with vocabulary and a conceptual framework to interpret the examples of learning that we observe. On the other hand, they suggest where to look for solutions to practical problems. Theories direct attention to the variables that are important in finding solutions, but do not themselves give the answers.

Behaviorism, Cognitive theories and Constructivism are the three main categories of learning theories. Behaviorism concentrates only on the objectively observable aspects of the learning process, while cognitive theories go beyond that to explain brain based learning, and constructivism regards learning as a process in which the child builds new ideas and concepts actively (Vaill, 1996:42).



2.3 CHALLENGES FACING MATHEMATICS TEACHERS

Castle (1971), states that, the essence of incorporating mathematics in education has gained worldwide recognition, as it has a great potential of improving the level and quality of education completely. Mathematics is the bases of creation and is also the bases of learning and any student who is excellent in mathematics has a greater probability in excelling in other subjects as well. He further explained that, today's era of technology cannot be discussed without making reference to mathematics. Technology relates it building blocks to mathematics and any nation that wants to develop technologically must pay special attention to the study of mathematics.

Mathematics teachers have noted that despite good training of teachers, still, there are some subject teachers who take mathematics subject teaching with many inadequacies causing them unable to cope with the demands of teaching mathematics (Castle, 1971). This causes a great amount of tension and stress which leads to poor performance in mathematics as a result of poor teaching.

However, mathematics teachers in the teaching and learning of mathematics in our education are faced by a lot of hindrances. Below are the challenges mathematics teachers' faces:

2.3.1 Managing classroom of students

Managing a classroom of students (disciplining students, assigning and collecting homework, assessing and evaluating students is a challenge mathematics teachers have. Classroom management according to Kelly (2017) is the term educators use to describe methods of



preventing misbehavior and dealing with it if it arises. In other words, it is a technique used to maintain control in classroom.

In managing a classroom of student's teachers face a lot of challenges, when teaching the whole class at the same time, children do not learn in the same way. Children who learn fast may benefit, whereas children who do not catch on quickly will be disadvantaged. Ebermeier (1983), and Brophy and Good (1986) argue that in individual cases, particularly poor performance in mathematics has also been associated with whole class teaching. For example, when the teacher uses the whole class teaching method he/she may not be able to interact with all the children at the same time. In such cases, problems experienced by some children are not promptly detected and remedied.

Olson (1971) also has shown that individual attention, interpersonal relationship, class activity and amount of creativity in a classroom decreased as class size becomes large. In UK, a recent study of 80 schools and 170 teachers measured achievement growth over the period of an academic, when using start of year achievement data by Fullarton and Sue (2000) on impact teachers had on achievement growth. The report showed that over 30% of variations in the pupils' progress were due to teachers. It concluded that teacher quality and teacher effectiveness, rather than classroom, schools and student factor are larger influence on pupils' progress.

Melissa (2017) argues that, discipline problem challenges most mathematics teachers and even teachers as a whole. Good classroom management combined with plan helps keep bad behavior to a minimum so the entire classroom can focus on learning. Teachers are sometimes afraid to discipline a student because of risk of suspension if they fail to handle situations



correctly. Classroom rules must be easy to understand and manageable hence lack of effective classroom management can mean that learning is reduced in classroom. For the mathematics teachers, it can cause unhappiness and stress and eventually becomes a challenge for mathematics teachers to perform. Children attitude in the learning of mathematics cannot be overlook (Kelly, 2017).

According to Costello (1991) “Positive attitude of student can however be regarded as valid objectives of mathematics education in their own right of effective learning outcome. Attitude such as enjoyment, enthusiasm, fascination and appreciation may be taken into account alongside the cognitive aspect of learning mathematics which is measured in terms of achievement. It’s therefore imperative that for teaching to be achieving well, student should develop the right attitude towards it and also their studies.

Added to the above mentioned, teachers should also try and do all that they can to make pupils develop interest in mathematic. They should adopt child centered methods of teaching and also to engage them in activities like games and others.

Furthermore, Kathleen (2015) asserts that, assigning and collecting of homework in managing a class room of students is a challenge facing mathematics teachers. The issue of homework is controversial in terms of its purpose, what to assign, the amount of time needed to complete it, parental involvement, its actual effect on learning and achievement, and impact of activities that occur outside the school hours. Mathematics homework is usually a daily event. Unfortunately, many teachers assign most homework from problems sets following the section of the text that was addressed that day. For the most part of the entire class gets the same assignment. (In fairness, mathematics teachers do take into consideration the nature of



that problem which is often grouped by difficulty, deciding which to assign based on the general ability level of students in classroom.

According to Kathleen (2015), Lack of understanding of tasks that is basic to teaching mathematics results due to inability to maintain discipline/classroom control, not motivating pupils' interest, not being organized, incomplete planning, failure to budget time, lack of command of subject matter and unethical behavior.

2.3.2 Curriculum overload

Curriculum overload is another challenge that mathematics teachers have; they feel overwhelmed and overloaded with topics they need to cover in mathematics before the session ends. Teach meets have long been a source of thematic projects and lessons using a variety of skills and resources in presenting such skills through thematic presentations, pupils can cover multiple curriculum areas and strands in one lesson.

In Ghana, studies have shown that even teachers who have an in-depth knowledge in mathematics cannot integrate them in their teaching and lack the basic skills in teaching. Ghana, like other African countries, suffers from a common crisis in teacher supply, lack of teacher expertise and inadequately trained individuals emerging from teacher training institutions. The problem lies not only in numbers but in specific categories of teachers entering the profession (Welch, 2006:326). Given the demography of the country and the need for mother tongue instruction at the basic level, undoubtedly this implies that rural schools are bound to suffer a lack of mathematics teachers or would be staffed with under-qualified mathematics teachers.



Mereku (2000) also observed that due to changes in the curriculum in mathematics had had on the performance of students. In his analysis, he cited a study commissioned by the Ministry of Education of Ghana in the early part of the decade. The study showed that mathematics teaching in basic schools focused on computational skills, learning of formulas, and rote practice of teaching as telling. The implication, according to him, was that by the time the majority of the pupils begin secondary education; their foundation in basic school mathematics was terribly low. Hence being a challenge teacher's face in teaching of mathematics.

2.3.3 Inadequate Curriculum Materials

Inadequate curriculum materials are a challenge mathematics teachers face. Curriculum materials are reference materials for teachers which contain detailed relevant information that directs the teacher to prepare adequate lesson notes and to teach effectively. This includes the teacher's guide, the syllabus, pupil's textbooks, pupil's workbooks and other relevant reference materials. The importance of textbooks cannot be over emphasized due to its close relation to classroom instruction. They help to identify topics and order them in a way student should explore them. Sometimes, how classroom lesson can be structured with suitable exercise and activities are also specified.

A study on the interaction of teachers with curriculum material is a relatively an unexplored area. Stodolsky (1989), on his study on the use and influence of textbooks in the classroom indicates that there was a high conformity between topics and instructional topics and less agreement between suggested activities in the teachers' editions and classroom practice. Additional, she stated that the teacher made no use of the manipulative activities and



suggestions for enrichment in the teacher's edition of the textbooks, at least not during her observations. Stodolsky made these observations when she observed six fifth grade teachers used student's teacher's edition of their mathematics textbooks. She proposed that textbooks influence should be analyzed with respect to topics, content of textbooks and the teacher's guide that go together with student texts.

Contrary to this finding is that made by Freeman and Porter (1989), they found that textbooks are not the content policy instrument they are billed to be.

2.3.4 In Structural Time

According to Evelyn (2015), Difficulties and challenges associated with time are more pronounced in developing countries, such as Ghana where class size is huge and learning materials inadequate. Time has been identified as one of the major factors militating against mathematics teachers' in teaching mathematics.

Limited mathematics periods in an inconsistent syllabus of Ghana Education Service are another challenge mathematics teacher encounter in junior high schools. Time tables of students are crowded and populated with ten (10) fanciful subjects of which mathematics is one of the subjects. Periods used in teaching mathematics are not enough to complete the syllabus or topics in mathematics before the external examination BECE hence leading to poor performance of pupils in mathematics?

Instructional time is one of the variables that are being established in the curriculum by curriculum developers. Government's national curriculums specify that teachers are expected to accomplish in a given period of time. It is worth pointing out that teachers who do not make



use efficient use of instructional time cannot complete the syllabus. (Lockeed and Verspoor, 1991).

In comparing the amount of instructional time in Ghana with that of other countries

Lockeed and Verspoor (1991) in a study concluded that the Ghanaian basic schools' falls far shorter than worldwide average. The following figures were indicated;

International Average Instructional Time	=	880 hours/year
Ghana's National Average Instructional Time	=	610 hours/year
Morocco's National Average Instructional Time	=	1070 hours/year

2.3.5 Poor Teaching Methodology

Teacher's choice of methods is very important in all aspect of lesson delivering but unfortunately, most teachers do sometimes employ wrong methods in teaching the subject. Mathematics by its nature requires methods which are practically oriented. Some scholars had it that pupils do understand better when learning is put into an activity form such as games.

Dienes theory of learning which relies on the theories of Piaget and Bruner is prescriptive as well as descriptive, because they did not only describe how mathematics is learnt but rather suggest how it should begin with application which the child can actually experience and gradually progress to formal mathematics summary. An important part of Dienes teaching is principles of multiple embodiments. This simple means that each concept should be presented during the lesson using as many difference examples and situations as possible.

From the words of Dienes et al "Children learn better when varied approaches are used in teaching a particular concept". For example, in teaching the mathematics concept "perimeter"



children should be allowed to measure round the chalkboard, table, door, window and others before developing the concept of perimeter as the distance round a close figure or object.

2.3.6 Teachers Attitude

An essential factor which is believed to greatly challenge mathematics teachers in teaching the subject is their attitude towards mathematics (Ernest, 1991). The teachers' attitude and approach to teaching have a most important effect on the success of delivery. This is as a result of the effect they can have on a child's attitude to mathematics and its learning (Aiken, 2000; King, 2006). Though the definition of attitude is not up-front I find Allport's 20th century definition still applicable. Allport (1935) defines attitude as "a mental and neural state of readiness, organised through experience, exerting a directive or dynamic upon the individual's response to all objects and situations with which it is related" (p.810).

This definition, points to advocate that real life experiences are vital in the formation of attitudes. In this regard, this study finds Allport's definition very important. It also shows that educational experiences cannot be restrained in the formation of attitudes. For example, a person who enjoys mathematics may have a positive attitude towards mathematics and may not see it as 'difficult' but 'fun'. On the other hand, a person with a negative attitude may not enjoy mathematics and will see mathematics as 'difficult' or 'rigid'. It follows that having a positive attitude in mathematics may include liking, enjoyment and interest in mathematics or their opposites (negative attitude), which in the extreme case can include mathematics fear (Ernest, 1991). Teacher's confidence in the appreciation of basic mathematical concepts and the value placed on mathematics is vital.



Unfortunately, mathematics teachers and teachers in general attitudes are not easy to change and serve as a challenge facing them. Little has been done to create such changes. Dutton (1962) discovered that once attitude was developed, that were very difficult to change. He advocated that continued efforts be made to change negative attitude through in-service instruction during school year. Added to the above mentioned, teachers should also try and do all that they can to make pupils develop interest in mathematic.

2.3.7 Teacher Supply

Arnhold, Bekker, Kersh, McLeish, and Phillips (1998) argues that, it is necessary and appropriate for professional teacher to have knowledge and skills that are needed to empower the teacher to enable him or her meet the challenges of facilitating student learning of mathematics and other core subjects. Through the guidance of the trained and capable mathematics teachers, students are able to learn through their misconceptions.

Mathematics is viewed as a difficult discipline and students often fail to grasp the concepts if they are not taught by a trained and experienced teacher who will help facilitate teaching learning using appropriate teaching methods and manipulative materials. Mathematics Education theory (for example, Piaget's cognitive theory of seriating and transitivity and Dienes' theory of mathematics learning) describes numerous body of abstract knowledge that has a large number of applications in the teaching and learning of mathematics. Mathematics teachers will become au courant with such teaching-learning theories when they go through a formal teacher training.

South Africa, like other African countries, suffers from a common crisis in teacher supply. The problem lies not only in numbers but in specific categories of teachers entering the



profession (Welch, 2006:326). She further argued that of newly qualified teachers, 80% are white, of which 66% are white women (Welch, 2006:326). Given the demography of the country and the need for mother tongue instruction at this level, undoubtedly this implies that schools and rural schools are bound to suffer a lack of teachers or would be staffed with under-qualified teachers.

2.4 THE IMPACT OF IN-SERVICE TRAINING (INSET) ON MATHEMATICS TEACHERS

Mathematics subject knowledge especially at primary and secondary levels has been recognized as an issue for some time within the mathematics community. (Ball, 1990), by policymakers (Alexander, Rose and Woodhead, 1992).

Teachers' mathematics knowledge has been known to have an important impact on instructional practices. A teachers' memories from the school years is a central influencing factor that affects its mathematics related beliefs, hence there is a need to enhance in-service teachers' positive attitude towards mathematics during training (Ball, 1990).

The training will be intended to encourage teachers to adopt new methods of teaching, integrate new knowledge and explore the uses of new technology. It is of critical importance to develop the human resources in the school system and the pedagogical process. The programme will aim to introduce new models of teaching proven to have positive effects on the learning atmosphere in general and in daily teaching situations in particular.

According to Ball, Hill and Bass (2005), the focus on subject matter knowledge rose at least in part, because of evidence that teachers lack essential knowledge for teaching mathematics. They again add that teachers' intellectual resources significantly affect students learning.



Despite this widespread interest of and concern what counts as ‘subjects matter knowledge for teaching’ and how it relates to students’ achievement remains inadequately specified in previous research (Hill, Ball and Bass, 2005).

Philosopher’s arguments as well as common sense, however, support the opinion that teachers subject matter knowledge influences their efforts to help students learn subject matter. Seldon (2003) explains that ‘one needs a solid understanding of the mathematics at and beyond, the level at which students being observed are working’. Post, Harel, Behr, and Lesh (1988) also argue that, ‘A firm grasp of the underlying concepts is an important and necessary framework for the elementary school teacher to possess; when teaching related concepts to children, and many teachers simply do not know enough mathematics’ (pp. 210-213). Simmons (1993) also contended that in order to teach well the teacher needs to know about the subject matter in both width and depth to a degree unlikely to be found amongst those beginning a teacher training course’ (p. 9).

Two decades ago, Shulman (1986) proposed three categories of teacher Subject Matter Knowledge (SMK). His first category, content knowledge or SMK, was intended to denote ‘the amount and organization of knowledge in mind of teachers’. he again explained content knowledge includes both facts and concepts in the domain, but also why facts and concepts are true, and how knowledge is generated and structured in the discipline.

The second category Shulman advanced was Pedagogical Content Knowledge (PCK). PCK consist of the ways of representing the subject which makes comprehensible to others. It also includes an understanding of what makes the learning of specific topics easy or difficult. PCK is in actual factto conceptualize the previously missing link between knowing something for oneself and being able to enable others to know it.



The last Shulmans category is the Curriculum Knowledge. This category involves the awareness of how topics are arranged both within a school year and over time and ways of using curriculum resources, such as textbooks to organize a program of study for students.

Ball, 1988; Fennema and Franke, 1992; Ma, 1999; Shulman, 1987), in addition to the continuing public and policy concern about improving teachers' knowledge of mathematics as a means to improve instruction and maximize student learning (National Commission on Teaching and America's Future (NCTAF), 1997).

The American Council of Education [ACE] (1999) believes that; 'A thorough grounding in college-level subject matter and professional competence in professional practice are necessary for good teaching. Students learn more mathematics when their teachers report having taken more mathematics' (p. 6). Askew and his colleagues (1997) research into teachers of numeracy, also suggests that primary school teachers with a 'connectionist' approach to teaching were able to see connections in the mathematics they were teaching. 'Connectionist' teachers were considered to be more effective in teaching mathematics.

Ma (1999) also compared Chinese elementary teachers who were mathematics specialist but had not studied mathematics beyond the age of 14, with USA generalist elementary teachers who studied mathematics at college level. She, however, found that the unique feature of Chinese teachers was their attitude to and understanding of mathematics. Some of the Chinese teachers in her study appeared to have a tremendously deep knowledge, something she defined as a 'Profound Understanding of Fundamental Mathematics (PUFM). Her study stressed the possibility of primary teachers developing a deep understanding of mathematics.



In these researchers' views, mathematical knowledge for teaching goes beyond that captured in measures of mathematics courses taken or basic mathematical skills. Teachers of mathematics not only need to calculate correctly, but also know how to use diagrams to represent mathematics concepts and procedures to students, provide students with explanations for common rules and mathematical procedures, and analyze students' solutions and explanations (Ball, Hill and Bass 2005).

By inadequately measuring teachers' knowledge, existing educational production function research could be limited in its conclusion, not only about the magnitude of the effects that teacher knowledge has on student learning, but also about the kind of teacher knowledge that produces effective student learning.

When teachers' knowledge of the subject that they teach (subject content knowledge) is rich, integrated and accessible, they tend to teach the subject more dynamically by using more varied ways (pedagogical content knowledge) while encouraging and responding more fully to learners' questions and comments (Brophy, 1991). On the other hand, when teachers possess inaccurate information or conceive of knowledge in narrow ways, they may pass on these ideas to their students. They may fail to challenge students' misconceptions; they may use texts uncritically or may alter them inappropriately.

With regards to this, Ball, Hill, and Bass (2005), however, argues that, 'although many studies demonstrate that teachers' mathematical knowledge helps support increased student achievement, the actual nature and extent of that knowledge whether it is simply basic skills at the grades they teach, or complex and professionally specific mathematical knowledge is largely unknown' (p. 16).



The mathematical knowledge important for the work of teaching is a significant issue in mathematics education and its impact is on in-service training to mathematics teachers.

2.5 STRATEGIES FOR TEACHING MATHEMATICS IN BASIC SCHOOLS

Teaching methods used by the vast majority of teachers that may have worked well enough for past generations are not working well enough today. There is the need to change educational strategies, and the place to begin is in the classroom.

Can teachers change what they do in the classroom in such a way that their students' understanding and abilities to use mathematics improve? Today, the goals of the majority of mathematics teachers are to cover the curriculum and meet the needs of an assessment. This has adversely shown that teaching strategies for these goals have failed to produce 'world-class learners'.

Learning mathematics can be significantly improved only if the teacher's primary goal is to develop a deep sense of understanding of the fundamental concept of curriculum.

Before presenting the strategies to improve teaching of mathematics, the modern view of learning established by John Dewey, Jean Piaget, and Lev Vygotsky called constructivism will be discussed. Education researchers, psychologists, and cognitive scientists have published hundreds, perhaps thousands, of research articles about various aspects of constructivism. Fortunately for teachers and curriculum developers, several authoritative sources have summarized and generalized the most relevant research. For example, in 1999 the National Academy Press published *How People Learn: Brain, Mind, Experience* and summarized and generalized the most relevant research.



McBrien and Brandt, in *The Language of Learning: A Guide to Education Terms*, describe constructivism as “an approach to teaching based on research about how people learn. Many researchers say that each individual ‘constructs’ knowledge instead of receiving it from others. They also describe teaching strategies that are based on the belief that students learn best when they gain knowledge through exploration and active learning. These strategies include using hands-on activities, encouraging students to think and explain their reasoning instead of merely memorizing and reciting facts, and helping students to see the connections among themes and concepts rather than presenting them in isolation.

Teachers can use constructivism or student centered method of teaching to teach the way students learn best but how? How does a “constructivist” classroom differ from a traditional classroom? Simply stated, teachers in constructivist classrooms engage students actively in the learning process. In these classrooms, students are more likely to discuss with other students their strategies for solving a problem instead of having the right strategy told to them by the teacher. They are more likely to be working cooperatively in small groups as they shape more likely to be engaged in hands-on activities than listening to lectures and are reformulate their conceptions, rather than practicing skills silently at their seats. They are constructivist classrooms, teachers establish in students a sense of interest and confidence and a need for understanding.

With the advancement of technology and the creation of the information highway in today’s society, students’ accessibility to technology in the classroom has also become important. Mathematics classrooms, in particular, have been shown to greatly benefit from the services that computers, calculators, and other devices can provide. For some children, understanding mathematical processes can be difficult and can evoke feelings of anxiety and fear. One way



in which teachers can alleviate these concerns is through the use of technology as an instructional tool.

According to Niess (1999), technology “brings abstract concepts to life in a colorful, interactive, engaging way”. She also emphasized that, students can utilize functions of computers such as calculators, spreadsheets, and interactive diagrams to better understand the mathematical concepts they are attempting to master; adding, “(students) can do the problem again and again without embarrassment until they get it right”. Computers can serve other purposes in the classroom beyond the lesson being taught at any given time.

Additional methods of technology such as virtual discussions can be used by both teachers and students to share new teaching methods and gather helpful information from others on topics with which students and/or teachers may be experiencing difficulties (Flecknoe, 2002). Furthermore, Kathleen (1997) states four principles supporting the use of technology in the classroom: technology allows instruction to be more “student-centered,” enforces the importance of “being a mathematician,” provides instant feedback to the student, and shifts the responsibility of student learning from “teachers and the text” to the students themselves.

According to Ball (2005), “mathematical knowledge of many teachers is dismaying and thin” (p. 14). One of the many suggested solutions to this problem is to require teachers to study more mathematics, either by requiring an additional coursework, or even stipulating a subject matter major. The problem with this view is that it is not based on adequate research evidence. It has not been possible to link teachers’ knowledge of the subjects to students’ achievement. Ball and her colleagues further suggest other solutions to include more practice-oriented approach, preparing teachers in the more mathematics they will use on the job. This approach calls for revamping mathematics methods coursework and professional development to focus



more closely on the mathematics contained in classrooms, curriculum materials, and students' minds.

In the UK, for example, the government specified for the first time a curriculum for Initial Teacher Training (ITT) setting out what was deemed to be the "knowledge and understanding of mathematics that teacher trainees need in order to underpin effective teaching of mathematics at primary level. Such a curriculum is founded on the belief that teachers' subject knowledge is an essential ingredient for successful teaching.

Poulson (2001) asserts that, in an effort to enhance the primary teachers' knowledge of the subject matter, and their professional expertise, subject-specific pedagogy is the assumption that teachers who know more teach better. The more knowledge a teacher possesses the better his teaching becomes. Thus Shulman (1986), according to Poulson, alleges that research on teaching, studies on teachers' knowledge and thinking are regarded as important aspects of educational research.

He further termed this type of study "pedagogical content knowledge" and claimed that it is a distinctive part of the teacher's knowledge base. Indeed, subject-specific pedagogy could be very effective in the teaching of a subject like mathematics. This strategy of teacher training would result in the production of better subject specific teachers which would thus better the children's understanding of the specific subject. This is what Ghana should look at in an effort to reduce the number of children experiencing difficulties to mathematics.

Another effective strategy for teaching mathematics is presenting mathematics in a symbolic way. Fagnant (2005 :) and Geary (2004) indicates that, mathematics is different from other sciences, objects don't have a tangible existence. In other words, mathematics can only be



presented symbolically. However, in mathematics classes, teachers use counters to develop children's skills of adding and subtracting. It is precisely this symbolic representation that needs clear and simple language together with examples from the children's immediate environment to understand mathematics.

In this regard, the role of the teacher is of vibrant importance. Attention should not, therefore, be dedicated on the symbols and their meaning, but rather on the activity of the symbolizing and meaning making (Cobb, Yackel and McClain: 2000). Therefore, the teacher who lacks language or skills to impart knowledge will be a barrier to children. The situation becomes even direr where the medium of instruction is a second language. This is a major obstruction for Ghanaian children and therefore strategies should be created to improve mathematics teaching.

According to the IRIS Center Peabody College Vanderbilt University (2016) explains effective strategy for teaching mathematics is the instruction based on evidence practice which is one whose effectiveness is supported by vigorous research. Three such practices for teaching mathematics include; explicit instruction, peer tutoring and cooperative learning.

Explicit instruction involves teaching a specific skill or concept in a highly structured environment using clear, direct languages. Peer tutoring involves two students working together on an in structural activity, periodically switching roles as tutor and tutee. Cooperative learning involves students working together in small mixed ability groups to maximize everyone's learning (IRIS Center Peabody College Vanderbilt University 2016).



2.6 CONCLUSION

This chapter presented the literature reviewed for the study. The area covered were: the conceptual framework, the theoretical framework and the review of literature on the key themes raised in the research questions such as: the challenges facing mathematics teachers, the impact of INSET on mathematics teachers, and the strategies for teaching mathematics in basic schools.



CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the research design and the procedures the researcher employed to obtain accurate data for the study. It discussed the processes involved in the conduct of the study and interventions placed to overcome this problem.

The key areas of the chapter include; Introduction, profile of the study area, the research approach, research design, population of the study, sampling and sampling techniques, data type and sources, data collection instruments, data collection procedure, situational analysis, intervention, post intervention, data analysis and presentation, data quality and ethical consideration.

3.0.1 Gaining access in to Dabokpa Circuit:

The researcher phoned the principals of all the ten (10) schools and scheduled an appointment with each one. Upon arrival, the researcher introduced herself and the purpose of her being there. She handed to the principals a letter requesting the said research to be conducted at their schools. The researcher further requested the principal to nominate one of the mathematics teachers with whom the researcher would work which was done out rightly in each school. The researcher introduced herself to the teacher and explained the purpose of the research and the role of the mathematics teacher in the study.



Dates were arranged with the mathematics teachers in all ten schools. The researcher thanked the teachers for agreeing to participate in the study and assured the teachers that the data gathered from them will be confidential.

Voluntary participation is vital, henceforth the researcher explained the purpose of the research and why she had included them in the sample.

3.1 PROFILE OF THE STUDY AREA

The Dabokpa circuit is situated in the Tamale South constituency of the northern region. It is Peri -urban in settlement and the schools within the circuit are dispersed. Some of the schools can be found around Dabokpa Senior Technical School on the hospital road while some of the JHS are adjacent to Ghana senior high school and Vittin Senior High School. The circuit comprises of a population of twenty- one (21) mathematics teachers.

3.2 RESEARCH DESIGN

The research design used in this study is action research. The reason for choosing this design is that, the ultimate aim or purpose of an action research design is to solve a particular classroom or social problem through the application of scientific methods and principles.

In a research, once the objectives of the project have been recognized, the issue of how these objectives can be met leads to a consideration of which research design will be applicable. A research design according to Amedahe, (2000) is described as a blueprint that specifies data relating to a given problem should be collected and analyzed (Amedahe, 2000).



Cohen and Manion as cited in Inkoom and Zuberu (2015, p. 177) defined action research as ‘a small-scale intervention in functioning of a real world and a close examination of the effects of such an intervention.’

According to Amedahe and Gymah, (2012), action research is a kind of research activity in which the researcher works hand-in-hand with others to solve classroom or locally related problems. In relation to this study, the researcher solves the issue of poor performance in mathematics in the Dabokpa circuit whiles working hand in hand with mathematics teachers to improve performance.

3.2.1 Strengths and Weaknesses of the Design

Action research does not only enhance the teachers professional and competence but also promotes teachers’ personal development and enhances skills when it comes to teaching and learning. Solutions to immediate problems in the classroom can easily be found with the help of action research. Action research equips the modern teacher with varied approaches that best suit learners at various levels. So through action research, the teacher evaluates his or her teaching strategies.

However, action research’s weakness is that, what happen in one place or school may not be the same in another school. For instance, reasons for low performance in Dabokpa circuit may not be the same at schools in another circuit. Action research is limited to some aspects of the problem and cannot be used in all aspect of man’s endeavors’. It is particularly good for school problem and also not base on the formation of policies or theories.



3.3 RESEARCH APPROACH

The study employed the mix method approach. The researcher made use of both the qualitative and quantitative research approach in conducting the study. According to Kuranchie (2014), qualitative research involves gathering of narrative data on variables over a period of time in order to gain insight into the issue of interest while quantitative research involves a research which is carried out to describe or explain a phenomenon numerically.

3.4 POPULATION OF THE STUDY

The population of the study comprises of all mathematics teachers in the Dabokpa circuit of the Tamale Metropolis. The Dabokpa circuit consists of ten (10) Junior High Schools (JHS) and twenty-one (21) mathematics teachers, comprising five (5) females and sixteen (16) males which in all constitute the target population for the study.

According to Polit and Hunglar (1996), In research, data are gathered from individuals to draw conclusions and inferences. Population refers to the target group that the researcher is interested in obtaining information from to draw conclusions. Population is said to be the entire aggregation of cases that meet a designated set of criteria.

The table below shows the list of the schools and the number of mathematics teachers gender related within the Dabokpa circuit.



Table 3.1: Mathematics Teachers Based On Gender.

No	NAME OF SCHOOL	# OF MATHS TEACHERS	SEX	
			MALE	FEMALE
1	SOBAHIYA M/A JHS	1	1	
2	DABOKPA JHS	3	3	
3	MAHAD TAHILIA ISLAMIC JHS	1	1	
4	MONAWARA M/A JHS	1	1	
5	DAKPEMA JHS	3	2	1
6	ST. JOSEPH R/C JHS 'A'	4	3	1
7	ST. JOSEPH R/C JHS 'B'	2	2	
8	TAMALE PRESBY JHS	3	1	2
9	VITTIN ANSUARIYA JHS	1	1	
10	WULSIE KUKUO R/C JHS	2	1	1
TOTAL		21	16	5

Source: Metro Education Statistics, Tamale, 2017.

Table 2: Shows the list of the schools and the number of mathematics teachers gender related of the Dabokpa circuit.

3.4 SAMPLE AND SAMPLING TECHNIQUES

3.4.1 Sampling Technique

Sampling is the process whereby a researcher chooses his/her sample (Inkoom and Zuberu, 2015). Probability sampling and non-probability sampling were both used in the study. Purposive sampling was adopted to produce the sample as it helped to target the teachers who could respond to the issues concerned in the study. This was also in line with the reasons given



by Agyedu, Donkor, and Obeng (1999) that, purposive sampling is chosen to suit the purpose of the study and that certain elements of the population are deliberately selected in the judgment of the researcher and nothing is left to chance.

3.4.2 Sample Size

The study was confined to basic schools (junior high) of the GES in the Dabokpa Circuit of the Tamale Metropolis. The circuit consists of twenty-one mathematics teachers, five (5) female mathematics teachers and sixteen (16) male mathematics teachers. The sample for the study comprised a total of 21 respondents who were purposively selected as the population for the study. The list of the respondents as illustrated in Table 1 was considered on grounds that it contained teachers who actually are mathematics teachers.

Four (4) schools within the circuit had only one teacher handling the subject for JHS one to three (1-3) whiles the six (6) remaining schools within the circuit had three (3) mathematics teacher for each class (JHS 1, 2 and three) respectively. As there is more than one teacher handling mathematics as a subject in some of the schools within the circuit, the researcher sampled all the twenty-one mathematics teachers in the Dabokpa circuit.

3.5 DATA TYPE AND SOURCE

The study draws on primary data (new data) and secondary data (existing data) for the study. Primary data is gathered through administering of questionnaires for mathematics teachers' respondents in the Dabokpa circuit and interviews schedule. For primary source, the researcher contacted the respondents in the field (schools) for first-hand information through the use of questionnaire and interviews. In this study, the administration of the questionnaire



involved self-completion. Questionnaires were given to respondents in the selected schools for the study for self-administration. Secondary data is also gathered from the circuit, that is BECE statistical summary over the period being studied.

3.6 DATA COLLECTION INSTRUMENTS

This study employed the use of three data collection instrument that is interview schedule, use of questionnaires and school records.

3.6.1 Interview

In the interview schedule, the open –ended questions was adopted.

Interviews are essentially, verbally administered questionnaires, in which a list of predetermined questionnaire asked, with little or no variation and with no scope for follow-up questions to responses that warrant further elaboration. Interviews are relatively quick and easy to administer (Gill, Stewart, Treasure and Chadwick, 2008). Based on the study, interview was scheduled for the research questions (Appendix B).

3.6.2 Questionnaires

The questionnaire for the mathematics teachers were all made up of close-ended items and grouped under four sections, A, B, C and D. The information sought from these sections included background information on the respondents from Section A, and information on the variables to be measured to answer Research Questions 1, 2 and 3 respectively, from Sections B, a four-point Likert scale (strongly agree, agree, disagree, and strongly disagree) was used for Sections C and D. (Appendix A)



A questionnaire is a collection of statement and questions on a paper to elicit answers to research questions. Open ended and closed ended questions are used in the study.

3.6.3 School Records

School records were used purposely for this research to study trends of students BECE results in the Dabokpa circuit from 2012 to 2017. In order to gain further insight into the research, the researcher collected all the relevant official and unofficial documents such as the teacher's work schedules, referral forms and the Mathematics curriculum learning programme as evidence to improve the trustworthiness of this study. The purpose for doing so was to establish the indulgent of the mathematics teachers with regards to Department of Basic Education (DBE) policies and the interpretation of it.

These records were also viewed as being vital in this study as they are precise. A record used in my analysis and referred in the text of this study includes;

Time Table: The time table could show how many times mathematics is taught a day and per week. It will also indicate at what time of the day is mathematics taught.

Mathematics curriculum: The Mathematics curriculum could indicate whether the teacher follows the policy as well as whether the teacher is on track with the curriculum. School record is suitable for this study because it afforded the researcher an opportunity to view the documents, policies and learning programmes that are used in teaching Mathematics. The researcher also established whether the teacher's Mathematics lessons fell in line with the policies.



These school records were analyzed and integrated with the evidence obtained through the questionnaires administered to teachers. The records enriched and supported the information collected. The following paragraph outlines why the researcher used questionnaire, interviews and school records in collecting data. As supported by Henning, Van Rensberg and Smit (2004) and McMillan and Schumacher (2010), records of documents constitute a useful and valuable source of evidence. In the following chapter, the questionnaires employed in the study are discussed.

3.7 DATA COLLECTION PROCEDURE

Data was collected from the mathematics teachers in the circuit as permission was asked. Required office was allocated for the administration of questionnaires and interview in each school, the researcher reminded them of the purpose of the study.

The researcher visited the schools of participants and booked appointments with participants for the administration of the interview and questionnaires. The questionnaire was undertaken using twenty-one (21) mathematics teachers from all ten (10) JHS from the Dabokpa Circuit in the Tamale Metropolis to ascertain whether the ideas used was well understood by respondents. The time taken to complete the questionnaire ranged from 20-30 minutes. Feedback on clarity of words and instructions were good, with no assistance needed. The importance of this exercise was that the questions that needed clarity were amended to get the right information. Another good thing about it was that time taken to finish the questionnaire and interviews as well as the response rates were known and this helped the researcher in the field work as to when to visit the schools in order not to interfere with lesson hours.

The researcher recorded details during interview with the use of tape recorder.



3.7.1 Situational Analysis

Preliminary activities were done to ascertain the problem of poor performance of Dabopka circuit JHS students in mathematics subject pertaining external examination BECE.

3.7.2 Intervention

The researcher designed a two-day in-service training modulo as a capacity building tool for the schools Mathematics teachers to improve their performance. Teaching strategies teachers were trained on includes; the use of technology (virtual class discussions), the use of symbolic representations, teacher centered methods and teacher subject matter knowledge. At this level, responses can be found in Unit 4.

In-service training (INSET) was in two folds that is School base where mathematics teachers with good teaching skill or curriculum teachers where facilitators for training and Circuit base where all the ten schools within the circuit mathematics teachers where involved in the training and the circuit supervisor and a resource person was invited to grace the training.

3.7.3 Post Intervention

The researcher made a follow up to the schools in the circuit after the implementation of the training to ascertain the effectiveness of the programme. How data was collected at this state refer to Unit 4.4, page 89 for details.

3.8 DATA ANALYSIS AND PRESENTATION

The researcher analyzed data manually and scientifically with the use of software analysis such as Excel and SPSS software. Data management is the assembling and keeping of data



accurately and securely and in the way that will be available and easy to use. After the instruments have been administered and collected, the data were coded, edited, cleaned and entered into the computer for further analysis. For challenges facing mathematics teachers, data was tested in the field to ensure that the information collected was accurately recorded. Before and during the data processing, the information was cross checked again to ensure completeness and internal consistency. Where some inconsistencies existed in the data due to mistakes made by the respondent, it was possible to detect and the interviewee concern was contacted for clarification in order to have the right information. This was possible and easy because the researcher assigned special identification codes to schools.

Relevant, accurate and reliable information was gathered for decision making. Also through the process of data review, cleaning, coding, entry and editing, flaws such as incomplete test instruments, unanswered items, as well as instruments with wrong responses were identified and the necessary corrections affected to render such instruments useful. Also, confidence of the researcher was enhanced for satisfying that the data he was drawing his conclusions on had been effectively managed. Using SPSS software package, descriptive statistics such as frequency tables, percentages and charts were used to emphasize on the results.

3.9 DATA QUALITY AND ETHICAL ISSUES

Bless, Smith and Kagee (2006) explain that the word “ethics” is derived from the Greek word “ethos”, meaning one’s character. It is related to the term “morality”. A moral issue is concerned with whether behavior is right or wrong, whereas an ethical issue is concerned with whether the behavior conforms to a set of principles.



Researchers such as Creswell (2010) and Bless et al (2006) agree that ethical issues are integral to the research process and therefore need to be carefully considered before the research process is finalized. An important ethical aspect is the issue of the confidentiality of the results and findings of the study and the protection of the identities of the participants. Creswell (2010) further adds that obtaining letters of consent, obtaining permission to be interviewed or questioned, undertaking to destroy audiotapes, and so on should be included in the ethical principles. In this study, the following ethical issues were observed.

3.9.1 Ethical Consideration

Permission: To conduct research in Dabokpa circuit of the Tamale Metropolis was approved by the Metro Education Director, the school governing bodies, the principals and the mathematics teachers to carry out the proposed research in all the ten basic schools. The researcher also submitted the project outline to the heads of institutions where the research was conducted so as to avoid deception and betrayal, and to ensure anonymity, confidentiality and honesty about the purpose of the study and the conditions of the research.

Confidentiality: To promote confidentiality, information provided by the participants, particularly personal information, was protected and not made available to anyone other than the researcher. All participants were assured of confidentiality by means of a written notice. Participants were allocated false name to protect their identities and to ensure confidentiality. The researcher reassured the participants that their real names would be kept anonymous and all data gathered would be kept confidential. The researcher introduced herself in order to gain the trust of the participants.



Data anonymity: The data collected from the participants was kept under safe conditions at all times. The researcher assured all participants that no person, except the researcher and the study leader would be able to access the raw data.

Anonymity: According to Creswell (2010: 143), Participant's data must not be associated with his or her name or any identifier; rather, the researcher may ascribe a number or symbol to a participant's data to ensure that the data remain anonymous.

Scientific ethics: Unethical behavior called scientific misconduct, which includes research fraud and plagiarism. Scientific misconduct occurs when a researcher falsifies the data or the methods of data collection. Scientific misconduct also includes significant departures from the generally accepted practices of the scientific community for conducting or reporting research Mouton (2006: 293).

Policies and procedures by research institutes and universities to enable detect misconduct and to report to the scientific community to punish the researcher who engages in it. The researcher is continually under the supervision of his or her sponsor and abides by the rules and regulations of the university.

3.10 VALIDITY AND RELIABILITY

3.10.1 Validity of the Data

An instrument is valid if it measures what it is supposed to measure (Creswell, 2010:216). There are different forms of validity, namely: Face validity, which refers to whether an instrument appears to measure what it is supposed to measure. Content validity, this validity refers to the extent to which the instrument covers the particular construct. It should measure



all the components of the construct. Construct validity, is the kind of validity needed for standardization. If for instance one measures intelligence, it must measure all personality factors related to intelligence. Criterion validity, construct indicates the correlation between the instrument and criterion. A high correlation implies a high degree of validity (Creswell, 2010:216).

To ensure the validity of the data collected, one of the methods employed was triangulation. According to White (2005:89), triangulation defines more than one source of data collection method in the study of human behavior. Consequently, questionnaires, interviews, and document analysis were all used in this study. To additionally validate the process, the researcher made follow up visits and conducted interviews in order to seek clarity on the interview transcripts from the participants. In going about the research, the researcher was at all times considerate of ethical issues such as informed consent, confidentiality, and possible effects on the participants. These presentations enhance the validity of the data.

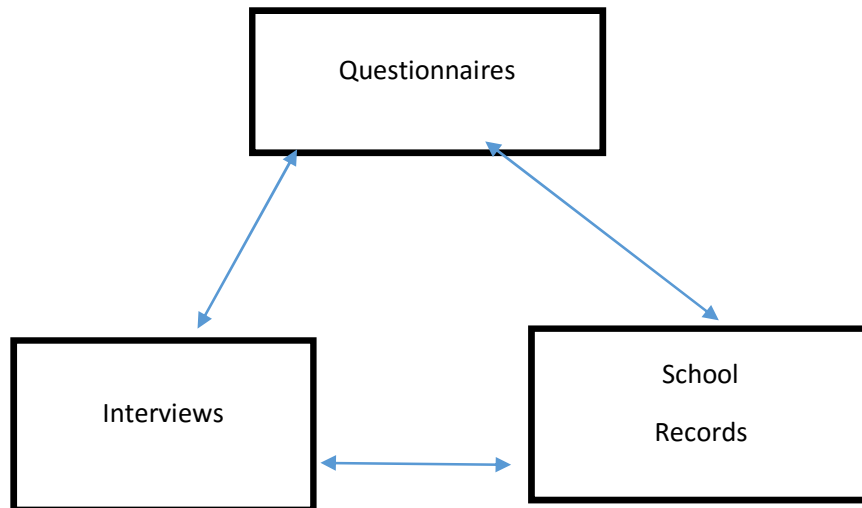
3.10.2 Reliability of the Data

Reliability is when the same instrument is used at different times but always gives the same results. In other words, the instrument is repeatable and consistent (Creswell, 2010:215). There are four different forms of reliability namely: Test - retest reliability – the same instrument is administered on the same subject at different times and the results are more or less the same. Equivalent form of reliability is obtained by administering the instrument and then on a second occasion an equivalent instrument is used to measure the same construct. Split – half reliability the items that make up the instrument are divided into two. The two separate “half instruments” are then compared. Internal reliability – is also referred to as



internal consistency when a number of items are formulated to measure a construct and there is a great degree of similarity (Creswell 2010:215 - 216).

Figure 3.1: Multiple Data used in the study



As this study was conducted among mathematics teachers in the Dabokpa circuit, the researcher could not separate the three instruments (questionnaires, interviews and school records), especially since these instruments are intertwined (David and Sutton 2004:133; McMillan and Schumacher 2010:33). The researcher used multiple forms of data so as to answer the research questions as supported by David and Sutton (2004:77) and also to promote triangulation.

3.11 CONCLUSION

This chapter described the research design and the procedures the researcher employed to obtain accurate data for the study. It discussed the processes involved in the conduct of the study and interventions placed to overcome this problem.





CHAPTER FOUR

RESULTS AND DISCUSSION OF PRE AND POST-INTERVENTION RESULTS

4.0 INTRODUCTION

This chapter presents and analyzes the data collected from the field. The chapter focuses on the analysis and the interpretation of these data with the view to answering the research questions stated in chapter one. In this background, using SPSS software packages to analyze data gathered, descriptive statistics such as frequency tables, graphs, charts and percentages

were used in the analysis. It is important to note that in the analysis of data some response categories were fused together for effective analysis.

4.1 DEMOGRAPHIC CHARACTERICS OF RESPONDENTS

The socio-demographic characteristics were very important as these could have some impacts on the person's behavior and could help explain an individual's views and opinions on issues and his/her way of life. The socio-demographic characteristics of respondents used in this study, which were found to be important for analysis includes; age, sex, location of school, highest level of education and professionally trained.

Table 4.1: Sex of Respondents

Sex of respondent		
Sex	Frequency	Percent
Male	16	76.2
Female	5	23.8
Total	21	100.0

Source: Field Survey, October 2017



The table above indicated the sex differences of respondents. It was revealed from figure 4.1.1 that majority of respondents were male teachers (76.2%) while 23.8% of the respondents were female teachers. Although majority of teachers were males, a significant number of them were females. It is essential to note that in Ghana most organisations including GES have always been male-dominated.

Table 4.2: Age of Respondents

Age of Respondent		
Age	Frequency	Percent
20-29	3	14.3
30-39	8	38.1
40-49	10	47.6
Total	21	100.0

Source: Field Survey, October 2017

Source: Field Survey, October 2017

Age is a vital factor in determining labour force participation in work in any organisation. Therefore, many employers take into consideration how long they would benefit from employee' working life. Table 4.1.2 above revealed that (14.3%) of respondents were within the ages of 20-29 (38.1%) fell between 30-39 years. (47.6%) of the respondents aged between 40-49 years.



From this presentation, it was revealed that majority of the respondents were in their youthful age and matured in terms of age. (Table 4.1.2).

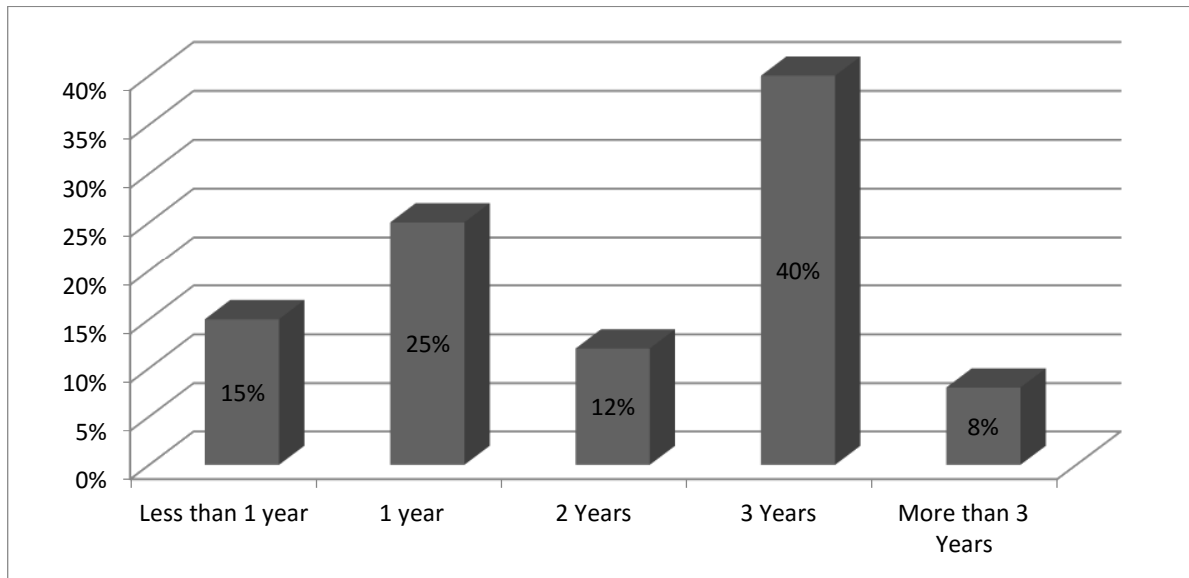
Table: 4.3 Location of School

Location	Frequency	Percent	Valid Percent
Peri-Urban	15	71.4	71.4
Urban	6	28.6	28.6
Total	21	100.0	100.0

The location of school was designated as urban and peri-urban areas. The data revealed that (28.6%) of mathematics teachers were in schools within the Tamale hospital road of the Dabokpa circuit whereas (71.4 %) were in the schools outside or far from the Tamale hospital road. The revelation was usually the case in most urban areas because there were more schools with large classes in the urban areas than in the peri-urban areas. Also, some teachers did not want to accept postings to the peri-urban areas because of the distance and the lack of social amenities (Figure 4.1.3).



Figure 4.1: Duration in the Teaching Profession



Source: Field Survey, October 2017

The above Figure indicated that, majority (40%) of the all the respondents working with GES have served in the teaching profession for than 3 years. Others respondents who have served less than 3 years, ranging from less than a year (15%), a year (25%) and exactly 2 years (12%) were also discovered by the study.

Table 4.4: Level of Education

Level of education	Frequency	Percent	Valid Percent
Senior secondary school	00	00	00
Vocational/technical	00	00	00
Teacher Training College	7	33.3%	33.3%
University	14	66.7%	33.3%
Total	21	100.0	100.0

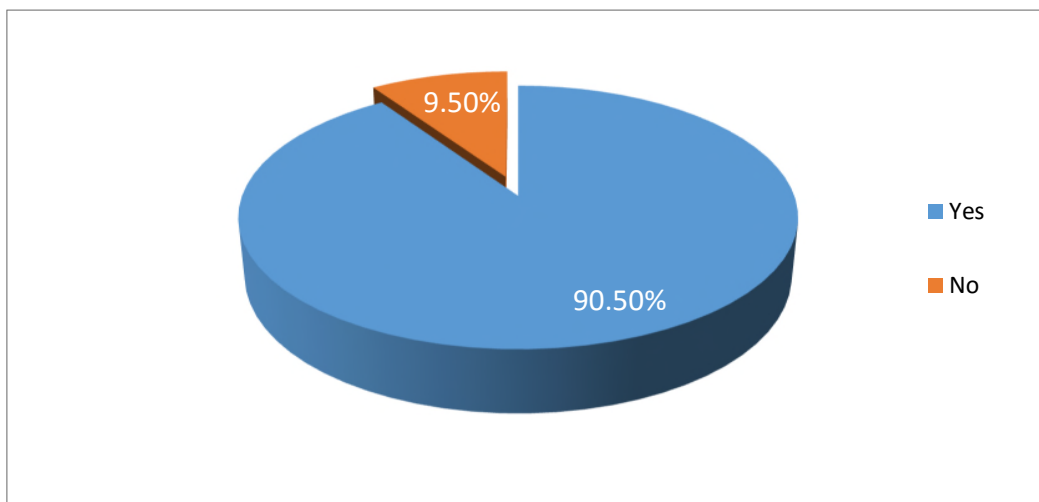
Source: Field Survey, October 2017



With regards to highest level of education, 7 respondents representing 33.3% are graduate from teacher training college, while fourteen (14) being the majority (66.7%) are university graduates. The combination of both training college graduates and university graduates from the above are the key respondents for this study.

Figure 4.2 Professional Background

In response to a question regarding the professional background of respondents, the study revealed that an overwhelming majority of basic schools' mathematics teachers in Dabokpa circuit (90.5%) of respondents were professionally trained whereas (9.5%) of the respondents were not professionally trained. This revelation confirmed the data on respondents' highest level of education indicated earlier. This further implied that the schools in the Dabokpa circuit in terms of quality human resource (teachers) did not have much problem. Below



Source: Field Survey, October 2017



4.2 DISCUSSION OF PRE AND POST INTERVENTION RESULTS

4.2.1 Research Question 1: what are the challenges facing mathematics teachers?

The intention of the researcher was to ascertain challenges mathematics teachers face in their line of duty. A situational analysis was conducted for the purpose of achieving the said objective in the Dabokpa circuit. The study from the pre-intervention stage used questionnaires, and in depth interview of mathematics teachers to seek responses.

Challenges facing mathematics teachers with questionnaire guide.

Table 4.5 With regards to classroom management, do you spend maximum time in teaching

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	20	95.2	95.2	95.2
No	1	4.8	4.8	100.0
Total	21	100.0	100.0	

Table 4.5 depicted the reaction of respondents to the question about with regards to classroom management, do you spend maximum time in teaching? The data indicated that 95.2% of respondents said they spend maximum time in teaching with regards to classroom management. Surprising, 4.8% also responded not spending maximum time in teaching with regards to classroom management.



Table 4.6 Do students actively participate effectively when teaching mathematics

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	15	71.4	71.4	71.4
No	6	28.6	28.6	100.0
Total	21	100.0	100.0	

In response to a question do students actively participate effectively when teaching mathematics, 71.4% attested that students actively participate effectively when teaching mathematics while 28.6% indicated that students do not actively participate effectively when teaching mathematics (Table 4.6).

Table 4.7 A great amount of tension and stress leads to poor performance in teaching mathematics

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	17	81.0	81.0	81.0
No	4	19.0	19.0	100.0
Total	21	100.0	100.0	

In response to the question a great amount of tension and stress which leads to poor performance in teaching mathematics, seventeen (17) of the respondents representing a percentage of 81.0% agreed while four (4) of the mathematics teachers representing a percentage of 19.0% indicated that a great amount of tension and stress does not lead to poor performance in teaching mathematics (Table 4.7).



Table 4.8 Poor performance in teaching mathematics has been associated with whole class teaching

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes	16	76.2	76.2	76.2
No	5	23.8	23.8	100.0
Total	21	100.0	100.0	

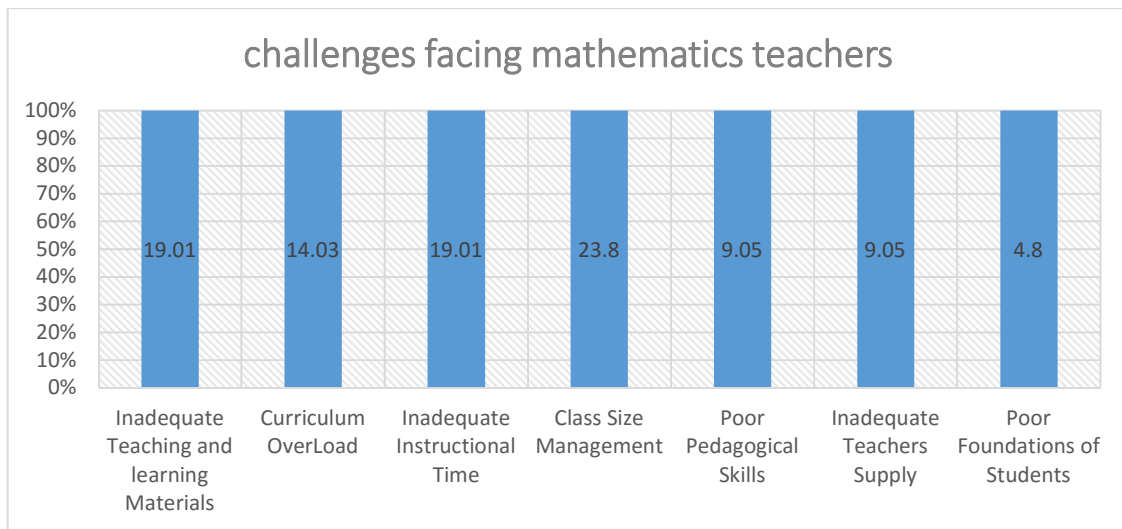
Table 4.8 Shows respondents' answers to questions about Poor performance in teaching mathematics has been associated with whole class teaching. 76.2% said that poor performance in teaching mathematics has been associated with whole class teaching while 23.8% responded that poor performance in teaching mathematics does not associate with whole class teaching.

In all the ten (10) schools comprising twenty-one (21) mathematics teachers, each teacher was interviewed to confirm the identified challenges. However, this was authenticated and confirmed by the interview schedule conducted with the mathematics teachers. Analysis of the interview brought forth the following general challenges teachers face in teaching mathematics. The identified challenges include:

- Inadequate TLMs/curriculum materials
- Curriculum overload
- Inadequate instructional time
- Class size management
- Poor pedagogical skills
- Teacher supply
- Poor foundations of students.



Figure 4.3 Challenges Facing Mathematics Teachers



Source: Field Survey, October 2017.

When respondents were asked to indicate their views on the Challenges facing mathematics teachers in their schools, majority (23.8%) of respondents indicated class size management. Large class size affects the performance level of students in the Dabokpa circuit. The teacher student ratio is so high that it makes teaching ineffective since a teacher to about 50 students in a class makes the teacher unable to identify students with difficulties in mathematics. 19.1% were those who cited inadequate teaching and learning materials (TLMs) such as textbooks, teachers' guide and syllabuses, mathematical instruments, among others. The revelation from the study is in consonance with the GES curriculum policy on mathematics, which is explicit (GES, 2010). However, the resources in terms of materials and personnel in the schools to successfully teach subject for example, teachers in the circuit are expected to provide instruction in mathematics but lacks the basic resources to facilitate effective teaching. Mathematics teachers therefore rely on their personnel efforts for purpose of effective teaching. This revealed that teachers teaching and learning materials were very influential in



the teaching of mathematics. The results of the study were giving evidence to Curriculum Research Development Division (2006), that curriculum of basic schools cannot be successful without adequate and appropriate teaching and learning materials. Furthermore, 19.1% also revealed that the in structural time was not sufficient to exhaust the overloaded curriculum of the GES before the stipulated time. The periods (30 minutes per period allocated per lesson was inadequate for effective teaching of the subject in schools. 14.3% attributed it to curriculum overload, 9.5% said it was that Mathematics teachers have poor pedagogical skills and knowledge in teaching. This suggests that teachers' competency is essential in teaching mathematics. 9.5% of the respondents complained of inadequate teacher supply. As argued by Arnold et al (1998) that, it is necessary and appropriate for professional teachers to have knowledge and skills that are needed to empower the teacher to enable him or her meet the challenges of facilitating student learning of mathematics. They further argued that, mathematics is viewed as a difficult discipline and students often fail to grasp the concept if they are not taught by a trained and experienced teacher who will help facilitate teaching using appropriate teaching methods and manipulative materials. Only 4.8% of the respondents pointed out that, students in the Dabokpa circuit do not have basic foundations in mathematics therefore making it difficult for them at the JHS level. The challenges in the Dabokpa Circuit was therefore persistent, since the finding suggested that there exists poor performance in mathematics in the schools within the circuit. The data presented in the figure 4.1 depicted challenges facing teachers which includes; class size management, inadequate teaching and learning materials, inadequate in structural time, curriculum overload, poor pedagogical skills, inadequate teacher supply among others.



4.2.2 Research question 2: What Is the Impact of In-Service Training on Mathematics Teachers?

In response to the research question above, post intervention assessed the impact of the intervention. Therefore, for this study, the data was collected and used. The researcher employed post intervention follow up to the schools within the circuit to ascertain the impact of the training given to the participants on improving skills and performance in mathematics.

Impact of In-service training on mathematics teachers with questionnaire guide.

Table 4.9 In-service training helps to develop human resources in schools

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	4.8	4.8	4.8
Agree	6	28.6	28.6	33.3
strongly agree	14	66.7	66.7	100.0
Total	21	100.0	100.0	

Table 4.9 depicts in-service training helps to develop human resources in schools in Dabokpa circuit. It was discovered that 66.7% of the respondents strongly agree that in-service training helps to develop human resources in schools. 28,6% also agrees that in-service training helps to develop human resources in schools. Whilst 4.8% disagrees that in-service training helps to develop human resources in schools. Thus the analysis clearly explains that human resources are developed with the help of in-service training in schools.



Table 4.10 In-service training encourages teachers to adopt new methods of teaching and integrate new knowledge

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	4.8	4.8	4.8
agree	5	23.8	23.8	28.6
strongly agree	14	66.7	66.7	95.2
Not sure	1	4.8	4.8	100.0
Total	21	100.0	100.0	

Concerning in-service training encourages teachers to adopt new methods of teaching and integrate new knowledge, 66.7% of the mathematics teachers strongly agreed that in-service training encourages teachers to adopt new methods of teaching and integrates new knowledge. Whilst 4.8% strongly disagreed with the answers given by their colleagues. On the same issue, 23.4% of the teachers agreed that in-service training encourages teachers to adopt new methods of teaching and integrate knowledge. Very few respondents (4.8%) were not sure if really in-service training encourages teachers to adopt new methods of teaching and integrates new knowledge (Table 4.10).



Table 4.11 In-service training improves teachers subject matter knowledge and influences their efforts to help students

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid neutral	1	4.8	4.8	4.8
agree	6	28.6	28.6	33.3
strongly agree	14	66.7	66.7	100.0
Total	21	100.0	100.0	

Table 4.11 presents information on in-service training improves teachers subject matter knowledge and influences their efforts to help students. 66.7% and 28.6% of the mathematics teachers (strongly agreed and agreed respectively) said subject matter knowledge acquired by in-service training influences teachers' efforts to help students, whilst very few (4.8%) of the teachers indicated that they were neutral.

Table 4.12 In-service training implements the knowledge and skills into practice

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid disagree	1	4.8	4.8	4.8
neutral	2	9.5	9.5	14.3
agree	6	28.6	28.6	42.9
strongly agree	12	57.1	57.1	100.0
Total	21	100.0	100.0	

Table 4.12 depicts in-service training implements the knowledge and skills into practice. It was discovered that 57.1% strongly agreed and 28.6% of the respondents also agreed that in-service training implements the knowledge and skills acquired into practice. Whilst 4.8%



disagreed that in-service training implement the knowledge and skills into practice. Very few of the respondents were neutral as they were not sure as to whether in-service training implements the knowledge and skills in practice.

In all the ten schools, twenty-one mathematic teachers were interviewed once again. Analysis of the post intervention interview revealed that the intervention (INSET) made was generally good. The interview revealed that mathematics teachers' usefulness in the schools has improved. This finding relates to Kazmi et al., (2011) since they argued that, in-service training for the mathematics teachers enables the teacher to be more systematic and logical in their teaching style.

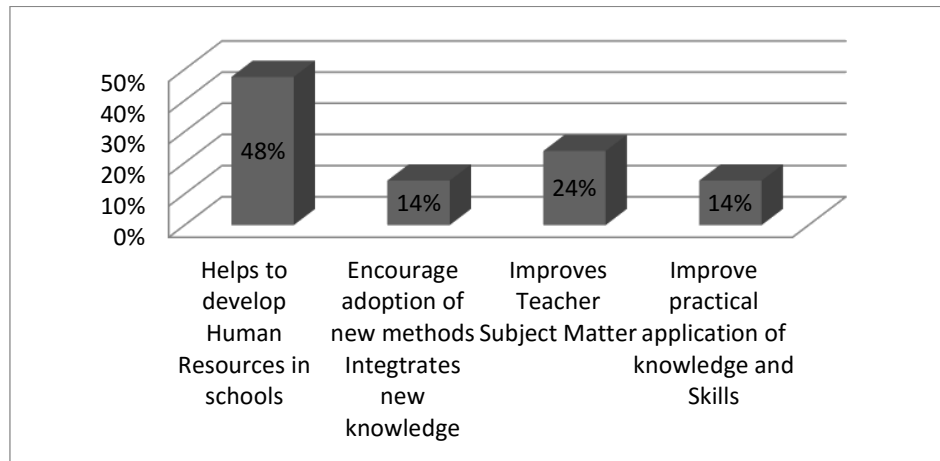
However, this was authenticated and confirmed by the interview schedule conducted with the mathematics teachers. Analysis of the interview brought forth the following impact of in-service training on mathematics teachers. The impact of in-service training on mathematics teachers includes:

- Helps to develop human resource in Schools
- Encourages adoption of new methods and integrate knowledge
- Improves teacher subject matter
- Improves practical application of knowledge and skills.

The bar graph below shows the various impact of in-service training on the mathematics teachers in the Dabokpa circuit of the Tamale Metropolis.



Figure 4.4: Impact of In-Service Training on Mathematics Teachers



Source: Field Survey, October 2017

With respect to the impact of the in-service training on mathematics teachers, 48% of the respondents mentioned that, in-service training helps to develop human resources in their respective school. Those who said it encourages the adoption of new methods and integrates new knowledge represented 14.3% of the sample. This implies that, the participants after acquiring the needed skills after attending in-service training have also shifted from the traditional lecture approach (teacher centered approach) to practical oriented approach (student centered approach). It was further revealed that, 23.8% of the respondents indicated that, in-service training improves teacher subject matter in teaching Mathematics. In the opinion of 14.3% of the respondents, said it improves practical application of knowledge and skills in the teaching and learning of Mathematics. The overall impact therefore points to the fact that, majority of the mathematics teachers in the circuit will now be adopting cooperate learning method, brainstorming and other practical learning methods such group discussions and demonstrations in teaching mathematics.



The skills improvement of the mathematics teachers after in-service training confirms with the findings of several theorist including Ball et al. (2005) who claimed that training was aimed at demonstrating that teachers' mathematical knowledge helps support increased student achievement, the actual nature and extent of that knowledge whether it is simply basic skills at the grades they teach or complex and preferably specific mathematical knowledge is largely unknown.

The mathematical knowledge important for the work of teaching is a significant issue in mathematics education and its impact is on in-service training to mathematics teachers.

The mathematics teachers who were interviewed, and complained of curriculum overload and could not teach some topics with the perception of being difficult during the pre-intervention stage where now able to do so effectively after the intervention stage improving performance in teaching mathematics. The 21 mathematics teachers had improved in pedagogical skills. This was improved after the intervention (INSET) was done and they gained knowledge through the training. This study also confirms the findings of Alice-Ong (1993) and Kazmi et al., (2011) who emphasize the impact of in-service training on the improvement in the skills and capability of mathematics teachers.

4.2.3 Research Question 3: Which teaching Strategies are effective for teaching Mathematics?

The researcher intended to seek information on the various strategies mathematics teachers use in teaching. The table below shows some selected strategies employed by the study in answering the research question.



Strategies for teaching mathematics in basic schools using questionnaire guide.

Table 4.13 Teacher subject matter knowledge influences performance

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	4.8	4.8	4.8
strongly agree	10	47.6	47.6	52.4
Not sure	10	47.6	47.6	100.0
Total	21	100.0	100.0	

The study looked at teacher subject matter knowledge influences performance (Table 4.13). The findings of the study reported below. 47.6% of the respondents strongly agreed that teachers subject matter knowledge influences performance. Whilst 4.8 % strongly disagreed that teacher subject matter knowledge influences performance. On the other hand, 47.6 % also indicated not sure if teacher subject matter knowledge influenced performance in the Dabokpa circuit. As claimed by Poulson (2001) that, in an effort to enhance the teachers' knowledge of the subject matter and their professional expertise, subject-specific pedagogy is the assumption that teachers who know more teach better.

Table 4.14 Teacher centred method of teaching mathematic is commonly used in teaching mathematics

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	4.8	4.8	4.8
Disagree	1	4.8	4.8	9.5
not sure	1	4.8	4.8	14.3
agree strongly	7	33.3	33.3	47.6
Agree	11	52.4	52.4	100.0
Total	21	100.0	100.0	



With regards to teacher centred method of teaching mathematics is commonly used in teaching mathematic (Table 4.14). An overwhelming majority of 58.7% of respondents agreed that teacher centred method of teaching mathematics is commonly used in teaching mathematics. A few of the respondents 9.6% stated that teacher centred method of teaching mathematics is not commonly used in teaching mathematics. Responding to the same question, 4.8% of respondents stated not sure teacher centred method of teaching mathematics is commonly used in teaching mathematics.

Table 4.15 The use of technology in teaching can help improve performance

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid strongly disagree	1	4.8	4.8	4.8
Disagree	1	4.8	4.8	9.5
not sure	1	4.8	4.8	14.3
agree strongly	18	85.7	85.7	76.2
Total	21	100.0	100.0	100.0

Table 4.15 In connection with the use of technology in teaching can help improve performance. 85.7% of the respondents indicated strongly the use of technology in teaching can help improve performance and 4.8% disagreed and 4.8% strongly disagreed that the use of technology in teaching does not improve performance. 4.8% claimed not sure the use of technology in teaching can help improve performance.



Table 4.16 The use of symbols can be used as a teaching strategy to improve performance in mathematics

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid not sure	1	4.8	4.8	4.8
agree strongly	9	42.9	42.9	47.6
Agree	11	52.4	52.4	100.0
Total	21	100.0	100.0	

Table 4.16 shows results from the data on the use of symbols as a teaching strategy to improve performance in mathematics. 52.4% and 42.9% of the respondents indicated that the use of symbols can be used as a teaching strategy to improve performance in mathematics. Whilst 4.8% of the respondents are not sure the use of symbols can be used as a teaching strategy to improve performance in mathematics.

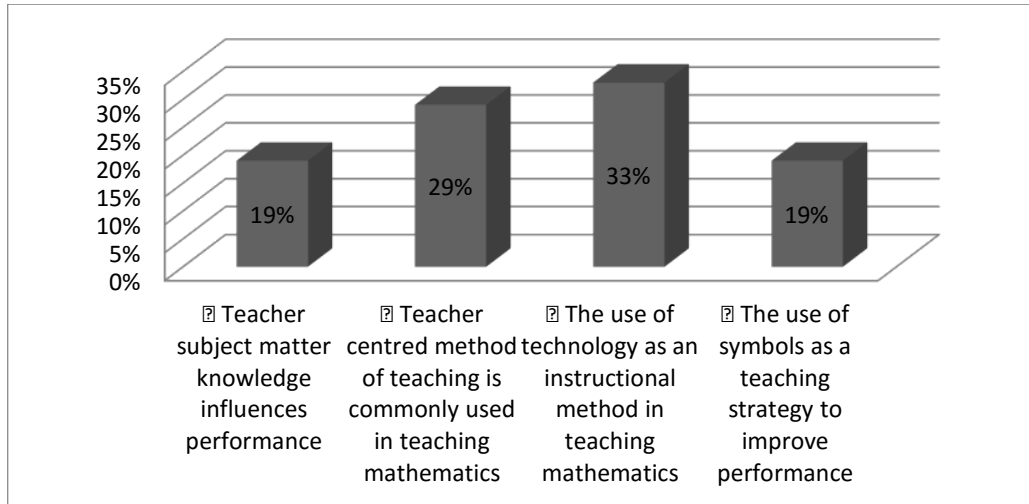
The twenty-one (21) mathematics teachers, each teacher was interviewed to confirm the strategies mathematics teachers use in teaching mathematics. However, this was authenticated and confirmed by the interview schedule conducted with the mathematics teachers. Analysis of the interview brought forth the following strategies teachers use in teaching mathematics in the classroom. The identified strategies include:

- Teacher subject matter knowledge influences performance
- Teacher centered method of teaching is commonly used in teaching mathematics
- The use of technology as an instructional method in teaching mathematics
- The use of symbols as a teaching strategy to improve performance



The diagram below represents the above strategies identified in teaching mathematics.

Figure 4.5 Strategies used in teaching Mathematic



When respondents were asked to indicate their views on the strategies used in teaching mathematics in their schools, majority (33%) of respondents indicated the use of technology as an instructional method in teaching mathematics is an effective strategy in teaching Mathematics. The use of technology as a strategy makes both the teacher and student participate effectively during tuitions period. Students can utilize functions of computer such as calculator and interactive diagrams to better understand the mathematical concepts they are attempting to master. This is related to Niess’s assertion. As claimed by Niess (1999), integration of technology into mathematics classrooms brings abstract concepts to life in a colorful, interactive, engaging way. Also added that additional method of technology such as virtual discussions can be used by both teachers and students to share new teaching methods gather helpful information from others on topics with which students and or teachers may be experiencing difficulties (Flecknoe, 2002).29% were those who cited teacher centered method of teaching as a common strategy in teaching mathematics. With this method the teacher leads



the discussion and allows students to solve problems and the teacher gives the right strategy to them. Teachers establish in students a sense of interest and confidence and a need for understanding. In this regard the role of the teacher is of vibrant importance hence attention should be dedicated to teachers who lack language or skills in teaching mathematics (Cobb et al., 2000). 19% indicated teacher subject matter knowledge as a strategy for teaching mathematics. This could become one of the effective strategies aimed at addressing on poor academic performance of students in Mathematics. It enhances the teachers' knowledge of the subject matter and their professional expertise, subject-specific pedagogy is the assumption that teachers who know more teach better. With regards to teachers' subject matter knowledge identified at the pre intervention stage, mathematical knowledge of many teachers is dismaying and thin. As Ball (2005) indicated that, one of the many suggested solutions to this problem is to require teachers to study more mathematics, either by requiring an additional coursework, or even stipulating a subject matter major. In response to the use of appropriate teaching and learning materials and use of symbolic representation, 19% of the teachers' said this should be directed towards attaining the academic targets. This could be one of the one of other strategies that could go a long way to improve on the effective teaching and learning of Mathematics. As Fagnant (2005) and Geary (2004) both indicates that, mathematics is different from other sciences and can only be presented symbolically. The study further gave evidence that, mathematics teachers lack language or skills in imparting knowledge to students. As majority of the teachers affirmed to this claim, Fagnant (2005) and Geary (2004) indicates that, mathematics is different from science; objects do not have tangible existence hence mathematics can only be presented symbolically. However, in mathematics classes,



teachers use counters to develop children's skills of adding and subtracting. Therefore, these symbolic that needs clear and simple language for the understanding of the students.

4.3 Intervention Stage

The study from the pre-intervention stage used questioners and in-depth interview of mathematics teachers to seek responses. Results for this stage can be found in chapter 4 (four) page 72-76. During the intervention stage, strategies such as the use of technology (virtual classroom discussions) was explained to the understanding of the teachers. Teacher subject matter knowledge was however emphasized and teachers were encouraged to improve their subject matter understanding to enhance the performance of students in mathematics. Furthermore, the use of appropriate teaching and learning materials, cooperative learning, peer tutoring and use of symbolic representations in teaching mathematics in various schools within the circuit was encouraged.

4.4 Post Intervention Stage

The post intervention stage assesses the effect of the intervention. Analysis of the post intervention interview revealed that the intervention (INSET) was generally good. The interview revealed that mathematics teachers' usefulness in the schools has improved. This finding relates to Kazmi et al., (2011) since they argued that, in-service training for the mathematics teachers enables the teacher to be more systematic and logical in their teaching style. The mathematics teachers who were interviewed, and complained of curriculum overload and could not teach some topics with the perception of being difficult during the pre-intervention stage where now able to do so effectively after the intervention, improving performance in teaching mathematics. The 21 mathematics teachers had improved in



pedagogical skills. This was improved after the intervention (INSET) was done and they gained knowledge through the training. This study also confirms the findings of Alice-Ong (1993) and Kazmi et al., (2011) who emphasize the impact of in-service training on the improvement in the skills and capability of mathematics teachers.

A follow up to the schools within the circuit after the intervention (INSET) further indicated that, cooperative learning and peer tutoring has been adopted by the teachers in teaching mathematics and performance has gradually improved on the part of both teachers and students. In improving the mathematical knowledge of the teachers, some of the teachers indicated applying for distance courses to improve performance.

4.5 CHALLENGES HINDERING THE EFFECTIVE IMPLEMENTATION OF PROGRAMME.

In implementation of a programme at the intervention stage, there existed certain challenges that hindered its effectiveness. Some of the challenges included; getting the mathematics teachers from all the ten schools to a particular venue for the programme, time factor, attendance, supplies for the training, food among others.

Limitation of the study

The study was conducted with some challenges, first and foremost, the unavailability of a policy manual made it difficult for the researcher to identify the policies and programmes of the Ghana education Service in the Tamale Metropolis. The researcher encountered difficulties in getting an acceptance letter from the directorate of education so as to be able to enter the schools and was delayed for several months. Also the uncooperative attitudes of



some respondents to the questionnaire pose a setback to the study. It was difficulty getting the Mathematics teachers to response to the questionnaire on time due to their busy schedules.

Another limitation was the length of the two-day in-service training program may not have been sufficient to develop significant changes in improving performance. Again, the researcher used the services of the Human Resource Management and the Circuit Supervisor of the Dabokpa in distributing and collecting the questionnaire

4.6 CONCLUSION

This chapter presented and analyzed the data collected from the field. The chapter focused on the analysis and the interpretation of these data with the view to answering the research questions stated in chapter one. SPSS software package was used to analyze data. Descriptive statistics such as frequency tables, graphs, charts and percentages was used in the presentation of analysis.



CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 INTRODUCTION

This chapter essentially deals with summary of the key findings which were obtained after analysis, interpretation and discussion of the data. Conclusion for this study is also drawn based on the findings as well as suggesting some recommendations. The main purpose of the study was to access and describe how using in-service training as a capacity building tools for JHS mathematics teachers can improve performance in the Dabokpa circuit of the Tamale Metropolis. Specifically, the study sought to identify challenges facing mathematics teachers as well as to be able to examine the impact of in-service training on mathematics teachers and also explore the effective strategies in teaching of mathematics in the Dabokpa circuit. The research design employed for the study was action research with a sample size of 21 mathematics teachers and the main instruments employed for the study were questionnaires, interviews and school record.

5.1 SUMMARY OF KEY FINDINGS

Analysis of the interview brought forth the following general challenges teachers face in teaching mathematics. This included: Inadequate TLMs/Curriculum Materials, Curriculum overload, Inadequate Instructional Time, Class size Management, Poor Pedagogical Skills, Inadequate Teacher Supply, and Poor Foundations of Students.

Most of the teachers indicated that, there's inadequate periods allotted to the teaching and learning material in the teaching Mathematics. The study further revealed that, challenges



facing mathematics teachers in teaching include; inadequate TLMs, curriculum overload, inadequate in structural time, class size management, poor pedagogical skills, attitude of mathematics teachers and inadequate teacher supply. The rest include inadequate INSET for mathematics teachers and lack of supervision from school authorities. An analysis of post intervention after INSET however revealed that mathematics teachers had improved in use of strategies in teaching mathematics. The competency level of the teachers had also improved. TLMs were provided in a form of other teaching materials aside what schools are billed to use.

It was again revealed that, in-service training has impacted the teaching of Mathematics in the following ways: it has encouraged mathematics teachers in the adoption of new methods of teaching, integrates new knowledge and improves practical application of knowledge. The effectiveness of the Strategies used in teaching mathematics was found not to be in doubt. Majority of them were now employing cooperative learning, discussions, brainstorming and peer tutoring as an in structural tool in teaching mathematics. However, there was an effective improvement in teaching mathematics in the circuit and most of the respondents recommended that INSET has contributed positively to their teaching profession and professional growth and development and also agreed that INSET updated and improved their teaching skills.



5.2 CONCLUSION

Mathematics is regarded as the foundation of scientific and technological knowledge that is very essential in the socio-economic development of the nation. As a result of this Mathematics is made a compulsory subject at all levels of education and also a basic entry requirement into most programmes such as medicine, architecture and engineering among other degree programmes. In spite of the important role that Mathematics plays in society, there has always been certain challenges that have negatively affected the effective teaching of Mathematics.

In detail, the study determined the challenges facing mathematics teachers, examine the impact of in-service training on mathematics teachers and also explore effective strategies for teaching mathematics in the Dabokpa circuit. In view of this, this study identified the main challenges facing mathematics teachers as inadequate TLMs, inadequate instructional time, poor teaching methodology, curriculum over load, inadequate supply of mathematics teachers among others. However, any factor that has a negative effect on instructional time had a direct bearing on the performance of pupils in their BECE mathematics results.

The study further examined the impact of in-service on Mathematics teachers. These effects were identified as the reduction of apathy among students in learning Mathematics, encouraging students' participation and the possibility of eliminating boredom in teaching Mathematics. In sum, the study has conclusively established the fact that, in spite of nationwide downward trend in Mathematics performance, the use of in-service has the potential of changing the trend.



There is the need to enhance in-service teachers' positive attitude towards mathematics during training to improve performance. The training encourages teachers to adopt new methods of teaching, integrate new knowledge and explore the uses of new technology.

The study therefore concluded that INSET should be organized suitably in a forms of SBI and CBI for mathematics teachers can improve performance.

5.3 RECOMMENDATIONS

Based on the findings of the study recommendations were made to the appropriate authority such as the Government, GES, and Schools and Non-Governmental Organizations (NGO's), and Schools to improve performance of mathematics teachers in and outside the Dabokpa circuit of the Tamale Metropolis.

5.3.1 Government

In order to improve performance of mathematics teachers in the Dabokpa circuit and beyond, the researcher recommends that government put more effort in the training of mathematics teachers, reward mathematics teachers in a form of motivation (scholarship awarded to devoted teachers), give high priority to the teaching of mathematics and supply more teachers and classrooms to address the large class size issues to improve teaching and learning within the Dabokpa circuit of the Tamale Metropolis



5.3.2 Ghana Education Services (GES) and Schools.

Again to improve performance of mathematics teachers in the Dabokpa circuit and beyond, the researcher recommends that GES should organize more frequent and regular in-service training for the mathematics teachers so as to keep teachers on track with respect to improving performance in mathematics education. This can help teachers be abreast with effective strategies in teaching mathematics to improve their skills and competence level and also handle certain topics in mathematics syllabus effectively.

In-service training such as School Based In-service (SBI) and Circuit Based In-service (CBI) should be intensified to upgrade teachers. Provide training to improve more efforts to avoid poor quality training through experienced and knowledgeable resource persons in facilitating Mathematics related subjects. Head teachers and curriculum leaders of the schools in the Dabokpa circuit should make in-service training a top priority so as to make the teaching and learning of Mathematics more attractive.

As a matter of urgency, teaching and learning materials especially teachers guides, pupils textbooks, current syllabus as well as curriculum materials are inadequately supplied thus affecting instructional efficacy hence the educational directorate should do their possible best to supply adequate logistics on time to the schools within the circuit to improve quality teaching.

There should be a review of the general time table so as to allot more time in the teaching of Mathematics, to ensure that students understand what is being taught in Mathematics, perhaps this can begin to increase students' academic learning and performance.



Mathematics teachers should further be encouraged to go for further studies to enable them appreciate different issues relating to the use of INSET in addressing the poor performance of students in Mathematics.

Men are found to always be in the forefront of the teaching Mathematics, women should be encouraged and assisted to Mathematics related course so as to enable them teach Mathematics effectively and also motivate female students in learning mathematics.

On a whole, the Foundations of students to learn mathematics should be encouraged at the primary level to improve their interest in mathematic.

5.3.4 Non-Governmental Organizations (NGO's)

Non-governmental organizations should help in the establishment of training centres for mathematics teachers. NGO's addressing Gender issues should put in place policies to encourage girls to take up mathematics courses to become mathematics teachers in future

5.4 RECOMMENDATION FOR FURTHER RESEAECH

The findings of this study have shown that there are still a number of things that need to be investigated concerning improving performance of mathematics teachers. Another way to expand this research could be to lengthen the study to include;

- Basic level (primary 1-6) and senior high school levels 1-3
- Using in-service training as a capacity tool to improve performance of SHS Mathematics teachers to improve performance.



- The same study could be conducted on a large scale. A greater number of mathematics teachers from a range of teachers in the Tamale Metropolis representing an increase in the sample size would be useful in drawing conclusions that would inform policy decisions.



REFERENCES

Abrefa-Gyan, K. (2010). *Human Resource Management for Professional Students*. 77-78

Adentwi, K. I. (2002). *Principles, practices and issues in teacher education*. Kumasi: Skies Printing Works.

Agyedu, G. O., Donkor, F., & Obeng, S. (1999). *Teach yourself research methods*. Unpublished.

Allport, G. (1935) Attitudes. In C. Marchisen (Ed). *The Handbook of Social Psychology* Vol. 2, pp. 798-844.

Amedahe, F. K. (2000). *Notes on educational research*. Unpublished

Amedahe, K. and Gyimah, A. (2012). *Introduction to educational research*. Mercury Press, Accra.

Anis, F. (2016). Observation as a research tool of qualitative research. Retrieved on 29th March, 2016 from <http://study.com/academy/lesson/what-is-sampling-in-researchdefinition-methods-importance.html>.

Alexander, R., Rose, J. and Woodhead, C. (1992). *Curriculum organization and classroom practice in primary school: A discussion paper*. London: Her Majesty's Stationary Office.

Alice O. and Char Y. (1993), Teacher improvement through staff development: problems and issues. Prosiding seminar Nativial ke-3: Pengurusen Pendidikan, Institute Aminuddin Balli.



American Council of Education, (1999). *To touch the future: Transforming the way teachers are taught. An action agenda for college and university presidents*. Washington, DC: American.

Arnhold, N., Bekker, J., Kersh, N., McLeish, E., & Phillips, D. (1998). *Education for reconstruction: The regeneration of educational capacity following national upheaval*. London: Oxfordshire.

Askew, Attwood, T. (2014). Why are Some Students So Poor at Maths? Retrieved on 2nd April, 2017 from <https://www.senmagazine.co.uk/articles/articles/senarticles/why-are-some-people-so-poor-at-maths>.

Ball, D. L. (1990). Prospective elementary and secondary teachers' understanding of division. *Journal for research in mathematics education*, 21, 132-144.

Ball, D.L., Hill, H.C., and Bass, H (2005). Knowing mathematics for teaching. Who knows mathematics well enough to teach third grade, and how can we decide? Available online: www-personal.umich.edu/~dball/ [Date of access: November 12, 2008].

Bless C., Smith, C.H. and Kagee, A. (2006). *Fundamentals of social research methods: An African perspective*. 4th Ed. Cape Town: Juta and Co.

Bor, S., (2011). The impact of in-service teacher education on language teacher's beliefs. *Science Direct system* 39(11), 370-380 u/c <http://liategl.british.council.org/2012/sites>.

Borko, H., and Putnam, R. (1995). *Expanding a teachers' knowledge base: A cognitive psychological perspective on professional development*. In T. Guskey and M. Huberman (Eds.), *professional development in education: New paradigms' and practices* (PP.35-66), New York: Teacher College Press.



- Borko, H. (2004), Professional development and teacher learning: Mapping the terrain. *Educational researcher*, 33(8)3-15.
- Brophy, J. E. and Good, T. L. (1986). Teacher behavior and student achievements. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 328-375). New York: Macmillan.
- Capel, S., Leask, M., & Turner, T. (Eds.). (2005). *Learning to teach in secondary school: A companion to school experience* (4th ed.). New York: Routledge.
- Carver, S. M., & Klahr, D. (Eds.). (2001). *Cognition and instruction*. Mahwah, NJ: Erlbaum
- Castle, E. B. (1971). *Principles of education for teachers in Africa*. London: Oxford University Press.
- Che Mohd Zulkifli, C. O. (2014). The need for in-service training for teachers and its effectiveness in school. *International Journal for Innovative Education and Research*, 2 (11), 1-9.
- Child, D. (2004). *Psychology and the teacher* (7th ed.). London: Continuum.
- Cobb, P., & Markel, G. (1990). Thinking strategies: Teaching arithmetic through problem solving. In A. R. Trafton & A.P. Shulte (Eds.), *New directions for elementary school mathematics*. (pp. 70-81). New York: National Council of Teachers of Mathematics, Inc.
- Cobb, Yackel, and McClain, K. (Eds.) 2000. *Symbolizing and communicating in mathematics classrooms: perspectives on discourse, tools, and instructional design*. Mahwah, N.J.:Lawrence Erlbaum Associates.
- Cockcroft, W. H. (1982). *Mathematics counts*. London: HMSO.



- Cohen, D. K., & Hill, H. C. (2000). Instructional policy and classroom performance: The mathematics reform in California. *Teacher College Record*, 102.
- Coruhlu, T. S., (epni, S. (2010). Reflection of an in-service education course program: Pedagogical content knowledge abt. Alternative measurement and assessment techniques and attitude development Elementary Education.
- Costello, J. (1991), *Teaching and Learning Mathematics*. pp. 11-16. London: Routledge.
- Creswell, J.W. (2010). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks: Sage.
- Curriculum Research and Development Division of Ghana Education Service (2001): *The teaching syllabus for Mathematics (JHS1-3) Accra*. Ghana Publishing Company (pp. v, vii.)
- Darling- Hammond, L. and Sykes, G. (Eds). (1999). *Teaching as the learning profession: Handbook of policy and practice* San Francisco: Jossey- Bass.
- Darling-Hammond, L. (2000). *Teacher quality and student achievement: A Review of state policy analysis variables. Educational Policy Analysis*.
- David, M. and Sutton, C. (2004). *Social Research: The basics*. London: Library of Congress Cataloguing- in- Publication Data.
- Davis-Kahl, S., and Payne, L. (2003). *Teaching, learning and research: linking high school teachers to information literacy*.
- Davies, P. J. & Hersh, R. (2012). *The Mathematical Experience*. Boston: Mifflin Company.



- Day, C. (1993). *Research and the Continuing Professional Development of Teachers*.
Inaugural lecture delivered at the University of Nottingham on 19th November 1993.
- Department of Education. (2003) Revised National Curriculum Statement Grades R – 9
(Schools): *Teacher's Guide for the Development of Learning Programmes*:
Foundation Phase. Pretoria: Department of Education.
- Dienes, Z. P. (1969). *The role of manipulative materials in teaching mathematics*, Hutchison
Education, London. Source: www.cehd.umn.edu/ci/rational numbers/81_4.html. D.A:
10/5/17.
- Donald, D., Lazarus, S. and Lolwana, (2010). *Educational psychology in social context*. 4th
Ed. Cape Town: Oxford University Press.
- Duncombe, R.J. and Amour, K. (2004). *Collaborative professional learning. From theory to
practice*. *Journal of in-service Education*, 30(1), 141-166. doi:
10.1080/13674580400200230. <http://dx.doi.org/10.1080/13674580400200230>.
- Ernest, P. (1991) *Philosophy of Mathematics Education* London: Falmer Press. arithmetic.
Arithmetic teacher 9:418-424.
- Essel, R. E. Badu, W. Owusu-Boateng and Albert A. Saah (2005). *In-service Training: An
essential element in the professional development of teachers*. *Malaysian journal of
distance education*.
- Ekpoh, V.I., Oswald, A., and Victoria (2013). *Staff development programmes and Sec. Sch
teachers job performance in Uyo Metropolis*. *Nigeria journal of Education and
practice*.



- Evelyn O. O. (2015), EdD; *Assessment in Mathematics Classrooms in Ghana: A Study Of Teachers' Practices*, University of Sussex United Kingdom. <http://sro.sussex.ac.uk/>
- Fagnant, A. (2005). *The use of mathematical symbolism in problem solving: An empirical study carried out in grade one in the French community of Belgium*. XX (4), 355-367.
- Farrant, J. S. (2004). *Principles and practice of education* (2nd ed.). London: Longman.
- Flecknoe M. (2002). How can ICT help us to Improve Education? *Innovations in Education and Teaching International*, 39(4), 271-279.
- Fredrick, B. J. A, and Stephen, O. O. (2010). Teachers perception of staff development programme as it relates to teachers' effectiveness: A study of rural primary schools in Kenya *Educational Research and Review*, 5(1),001-009.
- Fricke, E. Horak, L. Meyer, L and Van Lingen, N. (2008). *Lessons from a mathematics and science intervention programme in Tshwane township schools*. *South African Journal of Higher Education* Vol. 22 64 – 77.
- Gartrell, D. (1998). *A guidance approach for the encouraging classroom* (2nd ed.). Toronto: Delmar Publishers.
- Gattegno, C. (1970). *What we owe children: The subordination of teaching to learning*. New York: Outer bridge Dienstrey.
- Geary, D. C. (2004). *Mathematics and learning disabilities*. *Journal of Learning Disabilities*, 37, 4–15.
- Ghana Education Service inset project (2007), 2nd Ed Sample Lesson Plans in mathematics
5. GES Nationwide INSET Programme, Newsletter 10th edition, March 2015.



GES-JICA STM PROJECT (2004) *Manual for the teaching of science and mathematics in Basic Schools*. Accra, Ghana, Ghana Education Service.

Gitaari, E. M., Nyaga, G., Muthaa, G. & Reche, G. (2013). *Factors Contributing to Students Poor Performance in Mathematics in Public Secondary Schools in Tharaka South District, Kenya*. Retrieved on 2nd April, 2017 from <http://www.iiste.org/Journals/index.php/JEP/article/view/5281>

Good, T.L, Grouws, D.A., and Ebermeier, H. (1983). *Active Mathematics Teaching* New York: Longman.

Goulding, M., Rowland, T., & Barber, P. (2002). *Does it matter? Primary teacher trainees' subject knowledge in mathematics*. *British Educational Research Journal*, 28 (5), 689-704.

Graham, K. J. & Fennell, F. (2001). *Principles and Standards for School Mathematics and Teacher Education: Preparing and Empowering Teachers*. *School Science and Mathematics*, 101(6), 319-328.

Gronlund, N. E. (1976). *Measurement and evaluation in teaching* (3rd ed.). New York: Macmillan.

Grosso de Leon, A. (2001). *Higher education's challenges: New teacher education models for a new century*. New York: Carnegie Corporation Hammil.

Hartmann, C. (2004). *Using Teacher Portfolios to Enrich the Methods Course Experiences of Prospective Mathematics Teachers*. *School Science and Mathematics*, 104(8), 392-407.

Heavey L. (2004). *Leading professional development: A case study*. *The interval journal of educational management*.



- Heid, M. K. (1997). The technological revolution and the reform of school mathematics. *American Journal of Education*, 106(1), 5-62.
- Henning, E., Van Rensberg and Smith (2004). *Finding your way in qualitative research*. 2nd Ed. Pretoria: Van Schaik.
- Hierbert, J. (1997). *Making sense: teaching and learning mathematics with understanding*. United States: Heinemann.167
- Hill, W.F. (2002) *Learning: A survey of psychological interpretation (7th ed)*, Boston, MA: Allyn and Bacon.
- Houston and M. H. J. Sikula (Eds.). *Handbook of research on teacher education* (pp. 437 449).
- Hughes M. M. (2005). *Research to teach ICT: Lasses and composures*. Education, and Information technology.
- Illeris, H. (2004): *Educations of vision. Relational strategies in visual culture, Nordisk Pedagogik*, 24(4): 250-267.
- Inkoom, A. and Zuberu, M.B. (2005). *Research methodology in education: A practical guide*. Tamale, GILLBT Press.
- IRIS Center Peabody college Vanderbilt university (2016). *Effective strategies for teaching mathematics*. Vanderbilt Nashville USA. Website: <https://iris.peabody.vanderbilt.edu> DA: 29/5/2017.
- Jackson, T. W. (1982). Teacher education and benefits. *The Liberian Education Review*, 2 (2), 1-18.



- Jahangir, S. F, Saheem, N. J and Kazmi S. F. (2012) In-service training: *A contributory factor influencing teachers' performance*. International Journal of Academic Research in Progressive Education and Development.
- Kathleen Bryne (2015), the seven (7) biggest challenges to daily classroom innovation. <https://www.changex.org>. Date Assessed 10/4/2017.
- Kazmi, S. F., Pervez, T., Mumtaz, S. (2011). *In-service Teacher Training in Pakistan school and total Quality management, interdisciplinary Journal of Contemporary Research in Business*, march edition 2011.
- King, B. (2006) Elementary teachers' attitude towards mathematics and their preparation to Teach mathematics. From Pro Quest Dissertation and Theses. <http://proquest.umi.com/ezp01.libray.qut.edu.au/pqdweb?did=122217088\31&Fmt=7&clientId=14394&RQT=309&VName=PQD> Date accesses, 10th May 2017.
- Krajcik, J. S., Czerniak, C. M., & Berger, C. F. (2003). Teaching science in Education Inc.
- Kochhar, S. K. (2004). Methods and techniques of teaching. New Delhi: Sterling.
- Kuranchie, A. (2014). *Research made easy*, Kumasi printed by Bookworm Publications.
- Kutz, R.E. (1991). *Teaching elementary mathematics*. United States of America: Library of Congress Cataloguing- in- Publication Data.
- Lappan, G., & Schram, P. W. (1990). Communication and reasoning: *Critical dimensions of sense making in mathematics*. In A. R. Trafton & A. P. Schulte (Eds.). New directions for elementary school mathematics. (pp. 1 – 13), New York: NCTM.



- Lee H. L. (2005). Developing a professional development programme model based on teacher's needs. *The professional education spring*, xxvii (1 and 2), 39-40.
- Le Roux, K. (2008). *A Critical Discourse Analysis of a real-world problem in mathematics: Looking for signs of change*, *Language and Education*, 22(5): 307-326.
- Lockleed, M.E and Verspoor, A.M. (1991). *Improving Primary Education in Developing Countries*. The International Bank for Reconstruction and Development, Washington D.C. U.S.A pg. 1-60.
- Loucks- Horsley, S. and Matsumoto, C. (1995). *Research on professional development for teachers of mathematics and science: the state of the scene*. *School science and mathematics*, 99(5), 258-271.
- Lieberman, A. (1994). *Teachers development: commitment and challenges* in P. P. Grimett and J. Newfield (Eds), *Teachers development and the struggle of authenticity. Professional development and restructuring in the context of change*. New York Teachers: College Press.
- Lindquist, M. M. (1990). *It's time to change: Perspectives on change in elementary school mathematics*. In A. R. Trafton & A. P. Shulte (Eds.), *New directions for elementary school mathematics*. New York: National Council of Teachers of Mathematics, Inc.
- Locke, L. F. (1984). *Research on teaching teachers: Where are we now?* *Journal of Teaching Physical Education*. Monograph 2.
- M., Brown, M., Rhodes, V., Johnson, D., and William, D. (1997). *Effective teachers of Numeracy*. London: King's College.



- McMillan, J. H. (1997). *Classroom assessment*. Boston: Allyn and Bacon.
elementary and middle school classrooms: A project approach. (2nd ed.). Boston: McGraw-Hill.
- McMillan, J.H., and Schumacher, S. (2010). *Research in education*. (Evidence based inquiry) 7th Ed. United States of America: Library of Congress Cataloguing in Publication Data.
- Ma, L. (1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and United States*. Mahwah, NJ: Erlbaum.
- Mathematics Association of Ghana (2017), joy news D.A: Saturday 22nd July, 2017.
<http://www.myjoynewsprime.com>
- Mavroguorgos, G. (1993). *Forms of training. Conceptual declaration. The political-social framework*. Condition. synchrom expoidefoi 10,37-52 [in modern Greek].
- Melissa Kelly (2017), *article definition of classroom management*.thought.co. updated February 21, 2017. Date of Assessed 9th April, 2017 from
<http://www.thoughtco.com/definition-of-classroom-management-7734>.
- Mereku, K. D. (2000). School mathematics in Ghana. *Mathematics Connections, 1* (1), 18-24. Module 3 School-based and Cluster-based INSET (SBI/CBI) Manual.
- Moodley, M., Njisane, R. A., and Presmeg, N. C. (Eds) (1992). *Mathematics Education for In Service and Pre-Service Teachers*, Shuter and Shuter, South Africa.
- Mouton, J. (2006). *How to succeed in your master's and doctoral studies: A South African guide and resource book*. Pretoria: Van Schaik.



- National Commission on Teaching and America 's Future (1996). What matters most: Teaching for America's future (Report of the National Commission on Teaching and Americas Future). New York: Wood bridge.
- Niess M. (1999). Integrating Technology into Math instruction. *Media and Methods*, 35(3), 26-28.
- Oduro, E. O. (2009) Classroom Assessment Practices. Unpublished paper, University of Sussex, UK.
- Ohunche, R. O. and Obioma, G. O. (1983). *Perceived Competencies in Elementary Mathematics of some Teachers*. A paper presented to the Conference on Teacher Effectiveness.
- Omar C. M. Z. (2014). *The Need for In-Service Training for Teachers and its Effectiveness in School*. International Journal for Innovation Education and Research. Vol.2-11, 2014
- Ormrod,J. (1995). *Educational psychology: principles and applications*. New Jersey: Prentice-Hall, Inc
- Patricia Dubei (2007). Homework: A math Dilemma and what to do about it: <https://thejournal.com/articles/2017/4/2/hom.ework-a-math-dilemma-and-what-to-do-about-it.aspx?m=1>. Date Assessed: 9/4/2017.
- Piaget, J. 1952. *The origins of intelligence in children*. pp 1-20. New York: WW Norton and Co.
- Polit, D. F and Hunglar, B. P. (1996). *Nursing Research Principles and Methods*, J. B. Lippincott Company, Philadelphia.



- Poulson, L. (2001). Paradigm lost? *Knowledge, primary teachers and education policy*.
British Journal of Educational Studies, 49(1) 40-55.
- Post, T., Harel, G., Behr, M., and Lesh, R. (1988). Intermediate teachers' knowledge of
rational number concepts. In E. Fennema, T. P. Carpenter, and S. J. Lamon (Eds.),
Integrating research on teaching and learning mathematics (pp:177-198). Albany
NY: Sunny Press.http://www.aijcrnet.com/journals/Vol_2_No_6_June_2012/11.pdf
- Ronald W. Rebores (2004). *Human Resource Administration in Education: A management
Approach*, USA: Pearson Publication, Inc.
- Sa'ad, T. U. & Usman, R. (2014). *The Causes of Poor Performance in English Language
Among Senior Secondary School Students in Dutse Metropolis of Jigawa State*,
Nigeria.
- Seldom, A. (2003). Two research traditions separated by a common subject: mathematics
and mathematics education - Mathematics Department Technical Report. No. 2002-
2. D.A: 10/4/17.
- Schunk, D.H. (2004). *Learning theories*. 4th Ed. United States of America: Library of
Congress Cataloguing in Publication Data.
- Sharma, S. R. (1992). *Teacher education in India*. New Delhi: Anmol Publications.
- Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *Educational
Researcher*, 67, 4-14.
- Simmons M. (1993). *The effective teaching mathematics*, New York: Longman.
- Slavin, R., E. (2009). *Educational psychology: theory and practice*. Columbus, Ohio:
Pearson.



- Steyn, G.M. (2011). *Continuing professional Development in South African schools: staff perception and role of principals' journal of social science*, 28(1)43-53.
- Stodolsky, S. S (1989) Is teaching really by the Book. In P. W. Jackson and S. Haroutunian Gordon (Eds). *From Socrates to Software: The teacher as a text and the text as a teacher* (pp. 159 -184) Chicago: The University of Chicago Press.
- Tamale Metropolis Education Office (2012) *School Mapping Report for Tamale Metropolis; Tamale*.
- Themane, M.J., Monyeki, K.D., Nthangeni, M.E., Kemper, H.C.G. and Twisk, J.W.R. (2003). *The relationship between health (malnutrition) and educational achievements (Maths and English) in the rural children of South Africa*. *International Journal of Educational Development*, 23, 637–643.
- Thompson, J.T. (1992). *Developing and Implementing an in-service programme designed to change teachers' attitude towards mainstream learning disabled student at the secondary school level*. Research report. Ivova University.
- Vaill, P. B., (1996). *Learning as a way of being*. San Francisco, CA, Jossey-Bass Inc.
- Van de Walle, J.A. (2006). *Elementary and middle school mathematics* (7th Ed). Boston, MA: Pearson Education Inc.
- Vygotsky, L. (1978). *Mind in society*. Cambridge: Harvard University Press.
<http://www.collinsmaps.com/maps/South-Africa,-Republic-of/Gauteng/>
- Welch, T. (2006). Reaching Teachers? Curriculum challenges for distance teacher education in South Africa. *Africa Education Review* 324 – 327.



Wikipedia Free Encyclopedia, (2014). *Mathematics Anxiety*. Retrieved on 22nd April, 2017
From http://en.wikipedia.org/wiki/Mathematical_anxiety.

White, C.J. (2005). *Research: a practical guide*. Pretoria. Ithuthuko Investment (Publishing).

Whitin, P., and Whitin, D. J. (2006). *Making connections through math-related book pairs. teaching children mathematics*, 13(4), 196-202.

The concept of capability building by Vlaams institute voor de zee, platform voor marine onderzoek retrieved from [www.vliz.be/wiki/DA: 10/5/2017](http://www.vliz.be/wiki/DA:10/5/2017). Source: www.ucdoer.ie education theory.



APPENDICES

APPENDIX A

UNIVERSITY FOR DEVELOPMENT STUDIES

FACULTY OF EDUCATION

QUESTIONNAIRE FOR MAHEMATICS TEACHERS

This questionnaire is part of a study into **‘Using in-service training as a capacity tool for JHS mathematics teachers to improve performance: A case study of Dabokpa Circuit in the Tamale Metropolis’**. Your school has been selected as one of the ten schools to be studied. It is meant solely for academic purposes and as such sharing your honest views in response to it will help in accomplishing the task. You are assured that the information released, would be treated with the confidentiality that it deserves.

Kindly read through carefully and supply the answers you deem appropriate. Thanks in advance for your anticipated co-operation.

INSTRUCTION: Fill in the blank spaces and tick where appropriate.

SECTION A: BACKGROUND INFORMATION ON RESPONDANT

1. Sex: Male Female

2. Age: Below 20 20-29 30-39 40-49 Above 50

3. Location of School: Peri-Urban Urban

4. Highest Level of Education: S.S.S Vocational/Technical School Teacher Training College University Other, specify.....

5. Are you a professionally trained teacher? Yes No



6. When were you employed by Ghana Education Service (GES)? Less than a year 1 year 2 years 3 years More than 3 years

7. How long have you been teaching in your current school?

Less than a year 1 year 2 years 3 years More than 3 years

SECTION B: CHALLENGES FACING MATHEMATICS TEACHERS:

8. With regards to classroom management, do you spend maximum time in teaching? Yes No

9. Do students actively participate effectively when teaching mathematics in classroom? Yes
No .

10. A great amount of tension and stress leads to poor performance in teaching mathematics? Yes
 No

11. Poor performance in teaching mathematics has been associated with whole class teaching Yes
 No.

12. Individual attention and class activity in classroom decreases as class size become large? Yes
 No.

13. Do you feel overwhelmed and overloaded with topics to cover in mathematics before session ends?
 Yes No

14. Can inadequate mathematics teacher supply be as a result of low performance in basic schools?
 Yes No.

15. Are periods used in teaching mathematics adequate? Yes No



SECTION C: THE IMPACT OF INSERVICE TRAINING ON MATHEMATICS TEACHERS

With respect to the impact of in-service training on mathematics teachers, please indicate the extent to which you agree or disagree with the following statements:

SD = Strongly Disagree; D = Disagree; N = Neutral; Agree; SA = Strongly Agree

25. In-service training helps to develop the human resource in the school system. SD D N A SA

26. In-service training encourages teachers to adopt new methods of teaching and integrate new knowledge. SD D N A SA

27. In-service training improves teachers subject matter knowledge and influence their efforts to help students. SD D N A SA

28. In-service training implements the knowledge and skills into practice. SD D N A



SECTION D: STRATEGIES FOR TEACHING MATHEMATICS IN BASIC SCHOOLS

30. Please indicate the degree to which you agree or disagree with the following by ticking **ONE** of the alternative responses to each statement.

Statements/Responses	Strongly Disagree	Disagree	Not Sure	Agree Strongly	Agree
Teachers subject matter knowledge influences student performance					
Teacher centred method of teaching mathematics is commonly used in teaching mathematics					
The use of technology as an instructional method in teaching mathematics can help improve performance					
The use of symbols can be used as a teaching strategy to improve performance in mathematics					

THANK YOU ONCE AGAIN



APPENDIX B

Interview Schedule for Mathematics Teachers

Mathematics teaching and learning have remained problematic in basic schools' in Ghana. Various reasons have been attributed to the low pupils' performance in mathematics. The study seeks to use In-Service Training (INSET) as a capacity tool for JHS mathematics teachers to improve their performance.

Teachers are assured of anonymity and confidentiality.

Interview questions:

1. What are some of the challenges facing mathematics teachers in Dabokpa circuit?
2. How do you resolve the challenges facing mathematics teachers in Dabokpa Circuit?
3. What are some of the strategies used in teaching mathematics in your classroom?
4. How has those strategies mentioned benefitted your teaching?
5. What can be done to improve performance of mathematics teachers.?



APPENDIX C

SCHOOL RECORDS

TRENDS OF BECE ANALYSIS 2012-2017

BECE ANALYSIS OF MATHEMATICS SUBJECT FOR DABOKPA CIRCUIT

YEAR	TOTAL CANDIDATES REGISTERED			No OF CANDIDATES OBTAINING GRADE. 3-5			No OF CANDIDATES OBTAINING GRADE 6-9		
	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL	BOYS	GIRLS	TOTAL
2017	214	98	312	99	20	119	115	78	193
2016	293	198	491	68	21	89	225	177	402
2015	334	227	561	84	41	125	250	186	436
2014	246	338	584	120	52	172	126	286	412
2013	311	304	615	142	90	232	169	214	383
2012	392	231	623	92	43	135	300	188	488

Source: Tamale Metropolitan Directorate of Education



APPENDIX D

PICTURES DURING INTERVENTION



Picture of researcher and mathematics teachers after In-service training.



TIME TABLE INDICATING NUMBER OF TIMES MATHEMATICS IS TAUGHT IN A WEEK.

TAMALE PRESBY J.H.S.

DAY	CLASS	9:15		9:30		9:45		10:00		10:30		11:00		11:30		12:15		12:45		1:15		
		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
MONDAY	1	MATHEMATICS	MATHEMATICS	PRE-TECH	SOCIAL STU	FRENCH	FRENCH	SOCIAL STU	SOCIAL STU	P.E	P.E	P.E	P.E	P.E	P.E	P.E	P.E	P.E	P.E	P.E	P.E	
	2	MATHEMATICS	MATHEMATICS	P.E	P.E	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS
	3	DAGBANI	R.M.E	R.M.E	R.M.E	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
TUESDAY	1	P.E	P.E	P.E	P.E	FRENCH	FRENCH	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	
	2	P.E	P.E	P.E	P.E	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
	3	DAGBANI	P.E	P.E	P.E	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
WEDNESDAY	1	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
	2	B.D.T	B.D.T	B.D.T	B.D.T	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
	3	R.M.E	R.M.E	R.M.E	R.M.E	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
THURSDAY	1	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS
	2	DAGBANI	DAGBANI	DAGBANI	DAGBANI	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
	3	P.E	P.E	P.E	P.E	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
FRIDAY	1	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS	MATHEMATICS
	2	P.E	P.E	P.E	P.E	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU
	3	FRENCH	FRENCH	FRENCH	FRENCH	MATHEMATICS	MATHEMATICS	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU	SOCIAL STU

GENERAL TIME TABLE PRESBY J.H.S.

UNIVERSITY FOR DEVELOPMENT STUDIES



APPENDIX E

LETTER FOR REQUESTING TO CONDUCT RESEARCH

UNIVERSITY FOR DEVELOPMENT STUDIES
Faculty of Education
Department of Educational Foundations
Tamale Campus



THE DIRECTOR
GHANA EDUCATION SERVICE
TAMALE

Dear Sir/Madam

LETTER OF INTRODUCTION- MRS. HUSSEIN BAILLATU, UDS

We write to introduce the above named student of our institution who is doing research on "Using In-Service Training as a capacity tool for JHS Mathematics teachers to improve Performance: A case study of Dabokpa Circuit in the Tamale Metropolis." in partial fulfillment of the requirement for her degree.

The office would be most grateful for all support and courtesies extended to her in this endeavour.

Information so obtained shall be used solely for academic purposes.

Thanks in advance for your support

Sincerely,

Rev. Fr. Dr. Thomas Asante

(Coordinator)

Coord of Graduate Programs
Faculty of Education
U D S
P. O. Box 1350
Tamale, Ghana



APPENDIX F

GHANA EDUCATION SERVICE

In case of reply the date and reference number of this letter should be quoted

Our Ref: GES/HR/MD/OT/12/VOLI
Your Ref:

Email: metroedu@gmail.com



REPUBLIC OF GHANA

Metropolitan Education Office
P. O. Box 6, D/R
Tamale, Northern Region
Tel: 037-2022050

Date: October 23, 2017

LETTER OF PERMISSION

MS. HUSSEIN BAHIIA

Permission is hereby granted to Ms. Hussein Bahija, an M.ED student of the Department of Educational Foundations, University for Development Studies, Tamale Campus, to enter our schools to carry out research activities in so far as she obeys the various rules and regulations of the Ghana Education Service and the Ministry of Education guiding research activities in our schools.

Ms. Hussein Bahija is conducting a research on "Using In-Service Training as a capacity tool for JHS Mathematics teachers to improve Performance: A case study of Dabokpa Circuit in the Tamale Metropolis". Data is therefore to be gathered from some selected Schools in the Dabokpa Circuit of the Tamale Metropolis for the said research which will lead to the award of her Master in Education Certificate.

We kindly request all the selected schools to treat the researcher and/or her assigns with all the courtesies they deserve.

Counting on your kind cooperation.

(ISSAHUAQUE ABDUL-LATIF)
DEPUTY DIRECTOR, HRMD

for: METROPOLITAN DIRECTOR OF EDUCATION
TAMALE

**THE HEADTEACHERS
ALL SELECTED SCHOOLS IN THE
DABOKPA CIRCUIT, TAMALE**

Cc: Rev. Fr. Dr. Thomas Asante (Course Coordinator)
Dept. of Educational Foundations
University for Development Studies
Tamale.

The Circuit Supervisor
Dabokpa Circuit
Tamale

