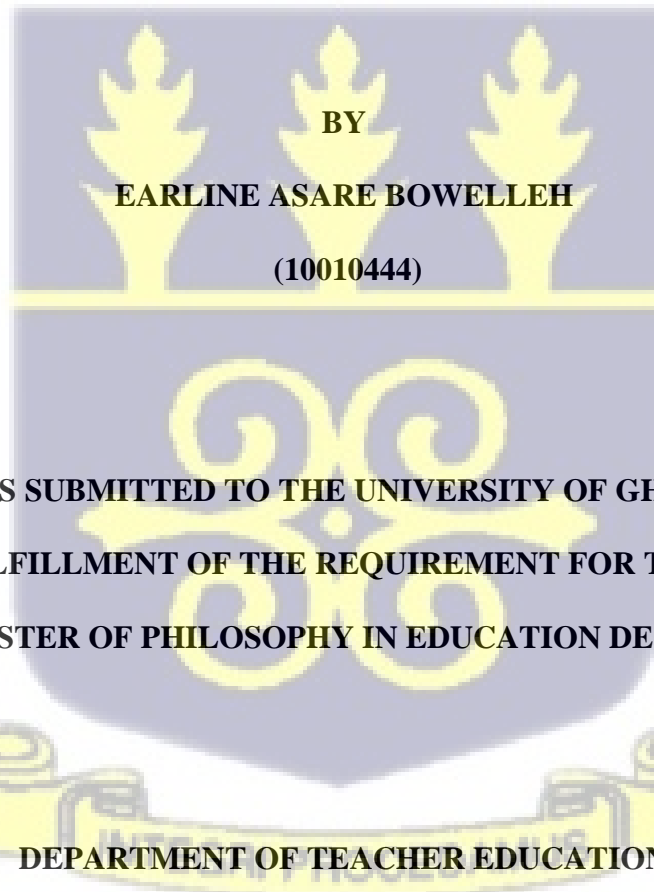


**UNIVERSITY OF GHANA
COLLEGE OF EDUCATION**

**TEACHERS' USE OF TEACHING STRATEGIES IN MATHEMATICS AND
INTEGRATED SCIENCE IN JUNIOR HIGH SCHOOLS IN
ABLEKUMA SOUTH SUB METROPOLITAN DISTRICT**



**BY
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**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN
PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF
MASTER OF PHILOSOPHY IN EDUCATION DEGREE**

DEPARTMENT OF TEACHER EDUCATION

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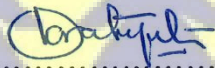
DECLARATION

I hereby declare that this study is my original work and that references to other people's work have been duly acknowledged. It has never been presented either in part or completely for another degree in this Institution or elsewhere.



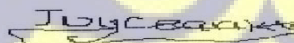
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Date. 16/12/2021



DEDICATION

This work is dedicated to Rose, Meshack, Meshack (Jnr), Michael and Edward. It is also dedicated to Champagne, my work companion.



ACKNOWLEDGEMENTS

My sincere gratitude and thanks go to the Almighty God for the opportunity, provision, protection, for going ahead of me and granting me favour and all the help I needed to do this study.

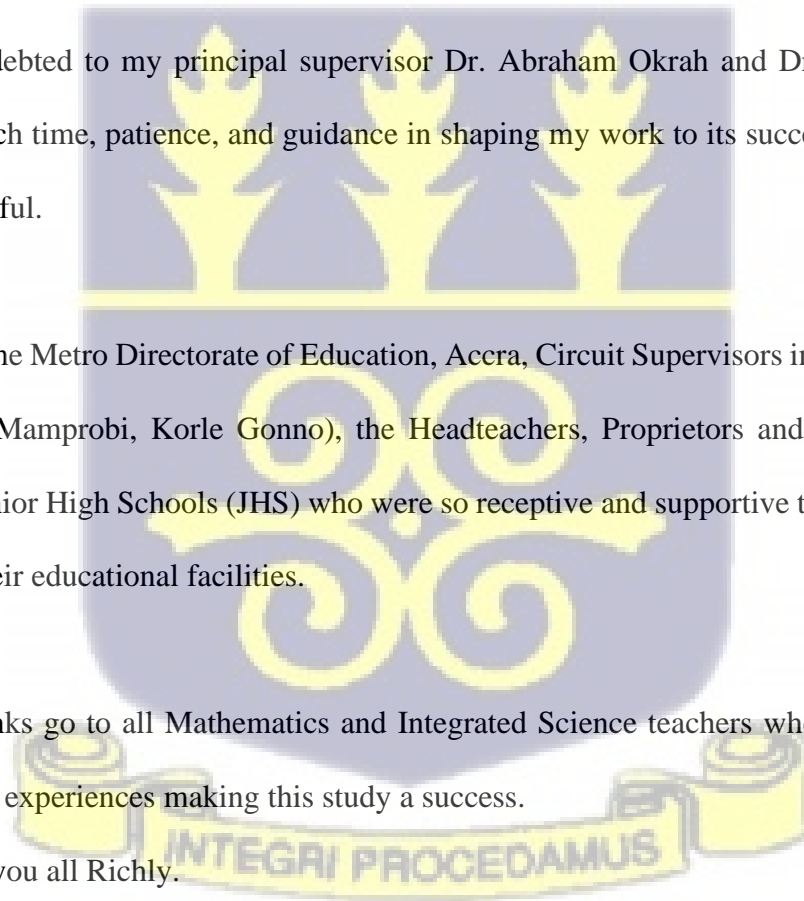
I also thank my husband Kwasi for his understanding and support throughout the period of this study as I run around to put it together. I also wish to thank and appreciate my father, Mr. Meshack Yaw Asare, my mother Madam Rose Tachie-Menson and my siblings especially Kofi Asare and Kwajo and Kwaku Asare for their immense support, prayers, and encouragement over the period.

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Finally, my thanks go to all Mathematics and Integrated Science teachers who participated and shared their rich experiences making this study a success.

May God bless you all Richly.



ABSTRACT

This study sought to investigate Junior High School teachers' use of teaching strategies, specifically teaching strategies in teaching Mathematics and Integrated Science in Accra. This case study attempted to explore what teaching strategies teachers use in teaching these core subjects, and whether these strategies are the supposed approved teaching strategies to be used in teaching these subjects, and the outcome of using these strategies as regards the students' performance in the subjects.

The population for the study comprised both male and female Junior High School Mathematics and Integrated Science teachers in the Accra metropolis who had taught these subjects for at least one year.

Ten (10) Schools made up of five (5) public and five (5) private were selected by purposive sampling from the Ablekuma South Metropolitan District of Accra, which has about 68 public and private Junior High Schools. Twenty (20) Junior High School teachers in all were sampled for this study, comprising ten (10) Mathematics and ten (10) Integrated Science. Data was collected using semi-structured interviews and observation to get participants' views on teachers' use of teaching strategies in Mathematics and Integrated Science.

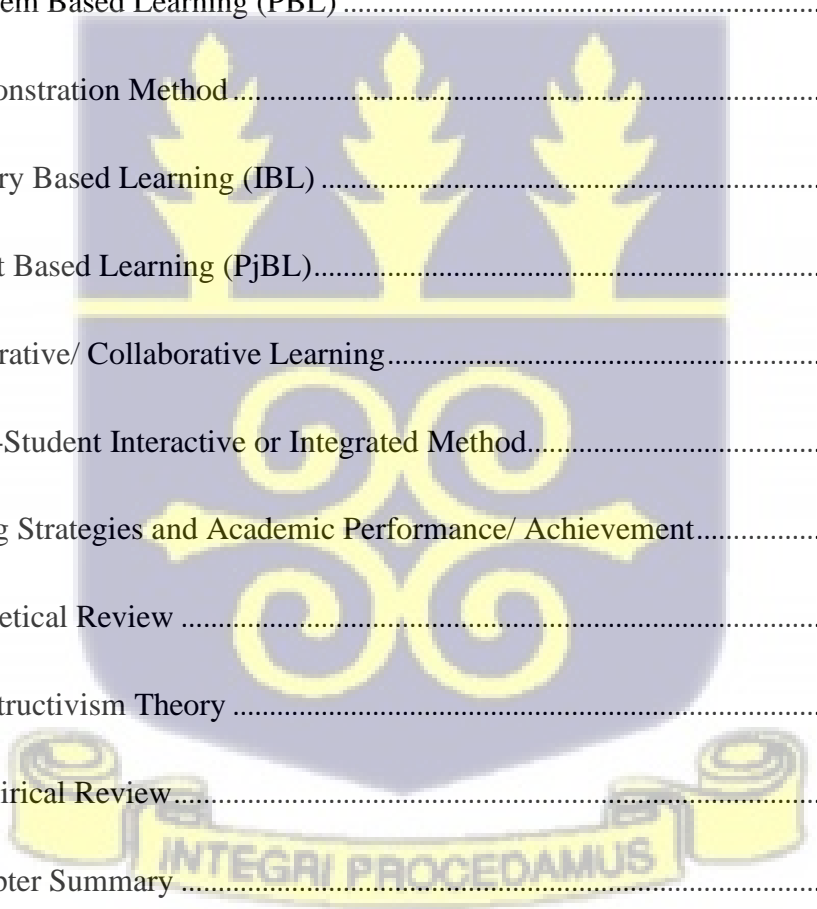
Open coding of teaching strategies into categories and identifying broad themes and ideas was done to help check for frequencies and aid analysis.

The study gave empirical evidence on teaching strategies used in teaching Mathematics and Integrated Science in Junior High Schools in Accra and revealed their appropriateness or otherwise in teaching these core subjects as well as how they impact the performance of students in the subjects in the classroom and ultimately at the Basic Education Certificate Examinations (BECE).

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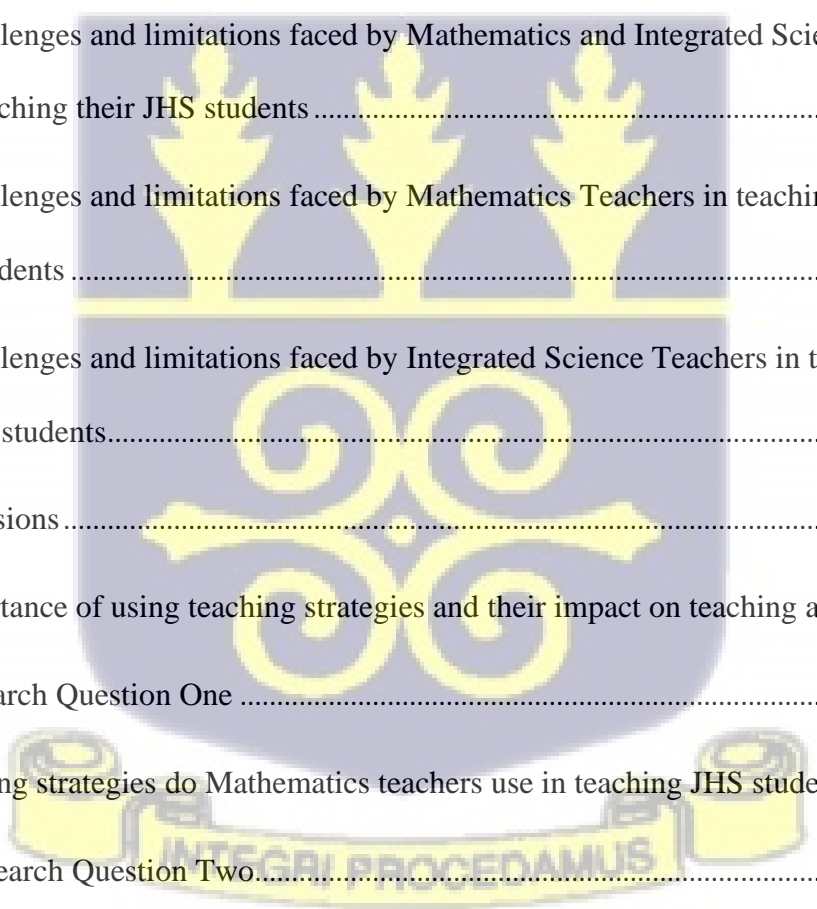
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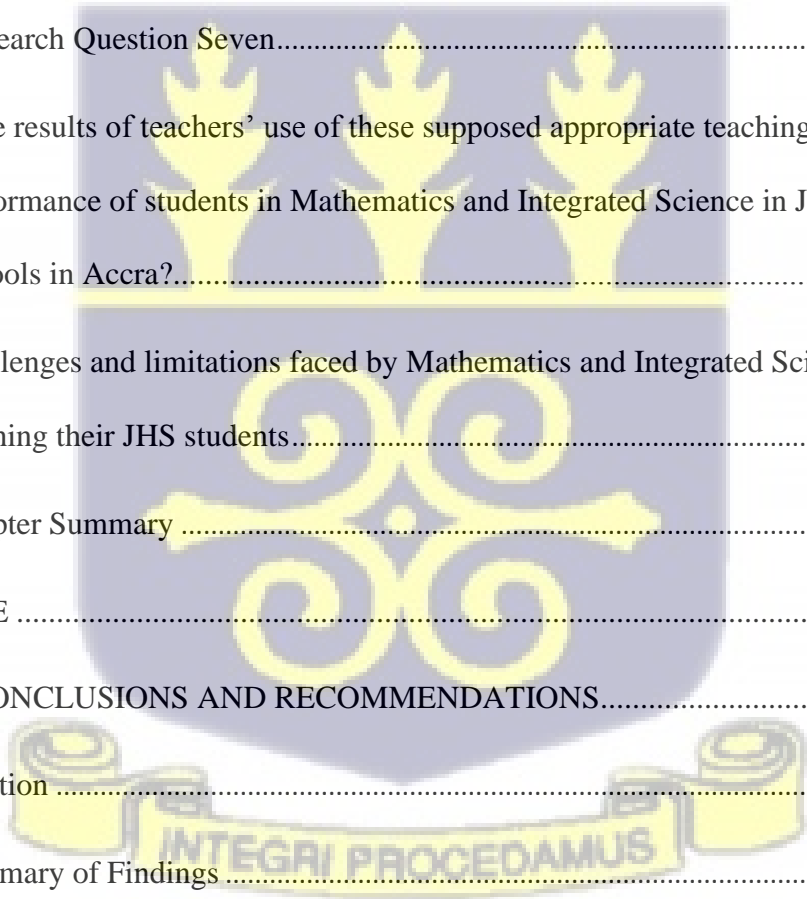
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LIST OF ABBREVIATIONS

BECE	-	Basic Education Certificate Examination
GES	-	Ghana Education Service
IBL	-	Inquiry Based Learning
JHS	-	Junior High School
PBL	-	Problem-based Learning
PjBL	-	Project Based Learning
WAEC	-	West African Examination Council
TIMSS	-	Trends in International Mathematics and Science Studies



CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The importance of education cannot be underestimated in any society of the world as this helps build society, develop individuals and nations at large (Boit, Njok, and Chang'ach, 2012). Teaching and learning enable students acquire skills such as communication, critical thinking and problem-solving (Atuahene, Yusheng, Bentum-Micah, & Owusu-Ansah, 2019). Also, knowledge, values and attitudes are acquired in the process of teaching and learning which bring about changes in students, that is, promotes learning (Ayeni, 2011; Tebabal & Kahssay,) and help develop nations. This ideal has led organisations worldwide to push the agenda for Education for All (EFA) to help solve educational challenges worldwide, especially in Africa (Barakat, Bengtsson, Mutarak & Kebede, 2016) as cited in (Atuahene et al., 2019).

Ghana for instance has seen a rise in school enrolment as a result and resolves to improve education (Fiaveh & Lamptey, 2011) as cited in (Atuahene et al., 2019) and thus dedicates a big chunk of its budget to the educational sector to ensure that learners acquire the requisite skills, values and abilities that will help them contribute to national development in the future. One result of good education is the academic performance of learners which mostly becomes evident with the extent of good performance in formative and criterion reference tests or assessments.

Mathematics and Science are two core subjects that are offered at the basic level of education worldwide and Ghana is no exception. This is because Mathematics and Science are the bases for Technological development which rules the world. Apart from this assertion, the 21st Century demands that learners develop critical thinking, problem solving, creative thinking and lifelong learning which can be developed through the proper teaching and learning of Mathematics and Science (Szabo, Guncaga, Szabo, & Neag, 2020).

The two main aims of science education in Ghana are to instill scientific knowledge in people which gives them knowledge in solving problems in a systematic and logical manner either in the workplace or everyday lives, as well as churning out professionals with competences in research and development at higher levels in order to come out with discoveries and inventions that would help solve different societal problems (Ameyaw-Baah, Amoah, Annafo & Darkeh Assem, 2018).

Mathematics education in Ghana is aimed at helping students to acquire the necessary skills that will enable them to succeed in their career and daily lives (Serebour, 2013) while enabling everyone develop the needed mathematical ideas and competencies to enable them to become relevant in society as they play their part.

However, students' poor achievement in these two core subjects has been a cause for longstanding concern for education researchers. Anamuah-Mensah and Benneh (2006) as cited in (Ameyaw-Baah et al., 2018) link the poor performance of students in science to the lack of indepth grasp of scientific concepts. Anamuah Mensah, Mereku & Ampah (2009) as cited in (Annafo, Agyei Amoah, Ameyaw Baah & Darkeh Assem, 2018) also add that the poor achievement at the basic level in Science and Mathematics leaves much to be desired of the teaching and learning of these subjects in Ghana. This further indicates that students do not understand what is being taught and this could also be linked to the methods being used to teach (Adunola, 2011). This has led the

Ministry of Education (MoE) to develop teaching frameworks that require teachers to structure their teaching to promote the development of innovation, communication, critical thinking, creativity, problem solving skills that are related to their everyday lives and also encourage lifelong learning in students (Ameyaw-Baah et al., 2018). The current curricula for Mathematics and Integrated Science highlight the use of learner centred approaches that put the student at the centre of learning. Both subjects' curricula promote the use of teaching approaches that are based on enquiry, collaboration, co-operative and differentiated learning (MoE, 2020).

The enquiry-based approach is a student centred strategy which has gained a lot of attention in the teaching of science and mathematics. It uses methods such as experiments, outdoor learning, projects, group work among others to actively involve students in the teaching and learning process to engage them in activities that require that they explore, research, gather and process relevant information that they interpret and share with their peers (Riordan, Hine & Smith 2019). Using these strategies enables students construct their own knowledge through participation in experiments and observations, relying on problems and questions and the problem-solving skills of students (Pedaste et al., 2015). Collaborative and co-operative methods such as grouping helps students learn from each other concepts that they previously found difficulty understanding (Capar & Tarim, 2015). Differentiated learning gives students a choice to learn in ways that suits their way of learning, as teachers modify lessons to meet students individual strengths, needs and abilities. This way they take charge of their own learning and construct their own meaning to learning (Boelens, Voet & De Wever, 2018).

The role of teaching strategies in education cannot be disputed and has constantly raised interest in the field of educational research as regard the impact that these methods or strategies have on student learning and for that matter how it affects their academic achievement (Hightower,

Delgado, Lloyd, Wittenstein, Sellers & Swanson, 2011). This is because teaching at any level of education is aimed at bringing about a change in learners. That is to say, teaching must translate to understanding and learning for students which ultimately translates to good academic performance or achievement and the development of the necessary skills, values and attitudes (Tebabal & Kahssay, 2011).

Coupled with this, students must be taught well to help them have a good grasp of mathematical and scientific knowledge, to enable them to develop the 21st Century higher order learning skills, such as critical and logical thinking skills, problem solving skills, creative thinking among others which can be achieved through knowledge and application of concepts in these two core subjects, to help them survive and move the world to greater levels of development (Vintere, 2018).

Kimani, Kara and Njasi (2013), have said that, academic performance of students is dependent on the effectiveness of teaching strategies and methods used by teachers. If teachers' instructional or teaching strategies and methods are ineffective, students will not achieve adequate progress academically and this may lead to poor academic performance of students, as the use of ineffective methods have been linked to poor academic performance of students (Adunola, 2011).

1.2 Statement of the Problem

Mathematics and Integrated Science are two core subjects that are taught at the basic level and advanced levels in the Ghanaian education system. Mathematics and Science are a requirement for many jobs in this age of technological advancement and also develops problem solving skills of learners. It is also believed that everyone needs some scientific knowledge to help them make

informed choices in a scientific and technological world, which is why Ghana is in agreement to the “science for all” goal MoE (2010) as cited in (Quansah, Sakyi-Hagan, & Essiam, 2019).

The Ghana Education Service reported in 2014 that BECE candidates failed in one or more core subjects and could not be placed in Senior High Schools through the Computerised School Selection and Placement System (CSSPS). These failures were attributed to candidates’ inability to apply scientific knowledge to physical phenomenon and failing at figures in standard form in the mathematics report (WAEC Chief Examiner’s Report, 2015).

Also in 2017, BECE candidates totaling 36,849 across the country could not be placed into senior high schools because they failed in one or more core subjects including mathematics and integrated science (Ansah, 2017) as cited in (Nugba, Quansah, Ankomah, Tsey & Ankoma-Sey, 2021).

According to the WAEC Chief Examiner’s report of 2018, there was a general decline in the performance of Integrated Science candidates. Also in 2019, it was reported that there was not much improvement in the performance of candidates as the majority of students scored only above average with only a few being outstanding (WAEC Chief Examiner’s Reports, 2018; 2019).

For Mathematics on the other hand, though performance was reported to be encouraging for 2017, candidates had difficulties such as finding the total shaded area of a plain figure, finding profit of a given item, and writing equations. 2019 performance was also reported to be slightly better than the previous year, however, candidates could not translate word problems into mathematical statements, and could not also solve basic computations without the use of a calculator (WAEC Chief Examiner’s Reports, 2017; 2019). These all speak to the abysmal performance by candidates in Mathematics and Integrated Science.

Students' difficulty with studying these subjects has prompted various studies into why most students perform poorly at these subjects. This has led to some research into the reasons for this poor performance in these subjects, such as Mathematics Anxiety in Students (Bruce, 2016). Others have also looked at factors such as socio-economic status, teacher quality and performance, availability of teaching resources, motivation, and student attitudes (Enu, Agyman & Nkum, 2015). A study into the performance of students in Integrated Science revealed that inadequate instructional materials and poor proficiency of pupils in the English language affected the teaching and learning of Integrated Science (Quansah et al, 2019).

Though the above studies can be cited in relation to the causes of poor performance in these subject areas in Ghana, little if any of these studies have been done looking specifically at teaching strategies used by Junior High School Mathematics and Integrated Science teachers in teaching their students. The gap that has been identified and worth researching therefore is the lack of research that explores teachers' use of teaching strategies in teaching Mathematics and Integrated Science in Junior High Schools in Accra, which this study seeks to explore.

Teaching strategies have been hailed severally by educationists as facilitating the process of knowledge transmission from teachers to students. Their importance cannot be overlooked as their use makes teaching effective (Ayeni, 2011). Teachers knowledge in various teaching strategies and their appropriate use of them, taking into consideration the subjects being taught and the learning outcomes to be achieved can also affect performance of students. Thus, poor performance of students can also be attributed to the inappropriate use of teaching strategies in teaching subjects, mathematics and integrated science being no exception (Adunola, 2011). It is important therefore to investigate teachers use of teaching strategies in these core subjects in Ghana to ascertain whether they are a contributory factor to the poor performance in these two subject areas.

1.3 Purpose of the Study

The purpose of this current study was to investigate teaching strategies and approaches being used by teachers in teaching Mathematics and Integrated Science in Junior High Schools (JHS) in Accra and to establish the appropriateness or suitability of these teaching methods in teaching these subjects as well as the challenges they encounter while teaching these core subjects.

1.4 Objectives of the Study

This study seeks to:

1. find out the teaching strategies that Mathematics teachers use in teaching JHS students in Accra
2. find out the teaching methods that Mathematics teachers use in teaching JHS students in Accra
3. find out the teaching strategies that Integrated Science teachers use in teaching JHS students in Accra
4. find out the teaching methods that Integrated Science teachers use in teaching Junior High School students in Accra
5. find out the supposed appropriate teaching strategies or methods that are used by teachers to teach Mathematics in Junior High Schools
6. find out the supposed appropriate teaching strategies and methods that are used by teachers to teach Integrated Science in Junior High Schools

7. find out the results of the teachers' use of these appropriate teaching strategies and methods on the performance of students in Mathematics and Integrated Science in Junior High schools in Accra

1.5 Research Questions

1. What teaching strategies do Mathematics teachers use in teaching JHS students in Accra?
2. What teaching methods do Mathematics teachers use in teaching JHS students in Accra?
3. What teaching strategies do Integrated Science teachers use in teaching JHS students in Accra?
4. What teaching methods do Integrated Science teachers use in teaching JHS students in Accra?
5. What are the supposed appropriate teaching strategies and methods that are used by teachers to teach Mathematics in Junior High Schools?
6. What are the supposed appropriate teaching strategies and methods that are used by teachers to teach Integrated Science in Junior High Schools?
7. What are the results of teachers' use of these supposed appropriate teaching strategies and methods on the performance of students in Mathematics and Integrated Science in Junior High schools in Accra?

1.6 Significance of the Study

This study is significant for three reasons, firstly, since this is a new area of study, findings will add new knowledge to existing ones. Secondly, stakeholders such as teachers, school heads and

other policy makers will also find the results useful in the implementation of the new knowledge in teaching strategies. The findings of this research would prompt teachers to reflect on their practice, in terms of teaching these core subjects and make them aware of how their teaching methods affect their learners' performance in these subjects. It would help them revise their selection of teaching methods in terms of suitability or appropriateness for the achievement of better learning outcomes.

School heads and other educational administrators can put in place measures to further improve the skills and competencies of teachers who teach these core subjects and help them identify methods and strategies that help in their delivery as well as affect students' performance in these subjects.

Again, since the area of study is new, it will create a new paradigm shift in research towards teaching strategies.

1.7 Delimitation of Study

The study was delimited to teaching strategies used by teachers of Mathematics and Integrated Science in Junior High Schools in the Accra metropolis which has a high population of Junior High schools. However, due to the vast nature of Accra geographically, limited time at the disposal of the researcher in doing this study, it was delimited to the Ablekuma South Sub Metropolitan District, drawing teachers from both private and public Junior High schools in the district.

There are about sixty-eight (68) Junior High Schools in Ablekuma South District of Accra where the study was carried out, out of which ten schools were selected for the study.

Twenty (20) teachers in all were selected from these Junior High schools in the district that teach Mathematics and Integrated Science. This number represents ten (10) JHS teachers each for both Mathematics and Integrated Science teachers in the district. This was to enable the researcher collect in-depth information on the topic under investigation from the sample, that was representative of the population.

The study sought to explore teaching strategies used by JHS teachers in both public and private Junior High schools in the selected area in teaching their students in these subjects and to ascertain the appropriateness of these methods, and challenges faced while teaching these subjects.

1.8 Limitations of the Study

Due to the limited time at the disposal of the researcher, observation of participants' teaching could not be done over a long period of time. All twenty teachers' classes were observed only once.

1.9 Organisation of the Study

The study is made up of five chapters. Chapter One comprises the introduction; background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, delimitations of the study and organisation of the study.

Chapter Two is the section on literature review; it reviewed literature related to the topic being researched and comprises an overview, conceptual, theoretical, and empirical review of literature.

Chapter Three looked at the research methodology. It includes the research design, study area,

population, sample size, instruments for data collection, data collection procedure and data analysis. Chapter Four focuses on the discussion of the results of the study.

Chapter Five provides the summary of key findings, conclusions, and recommendations.

1.10 Chapter Summary

This chapter deals with the general overview of the study and explains why it is necessary to establish teachers' use of teaching strategies in Mathematics and Integrated Science in Accra. The research questions and the existing gap has been stated. The results of this study will provide answers to questions related to the study.

The next chapter reviews various literature on the subject under study.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews relevant studies on teaching strategies in general, their impact on academic performance in general and as pertains to Mathematics and Science. It also covers conceptual, theoretical, and empirical reviews which the study is premised on.

2.2 Conceptual Review

The concept of teaching has been defined severally by many educationists and educational researchers over the years. Amidon (1967) as cited in (Rajagopalan, 2019; pg. 6) defines it as *“an interactive process, primarily involving classroom talk which takes place between teacher and learner and occurs during certain definable activities.”* It has also been described as *“a scientific process composed of content, communication, and feedback, with teaching strategy having a positive effect on student learning”* (Davis et al., 1962; Gagne et al., 1974 and Gage, 1978) as cited in (Rajagopalan, 2019; pg. 6). Students’ academic performance is linked with teachers’ use of appropriate teaching strategies in the learning environment. Using teaching strategies that suit subjects and lessons to be taught is an effective way of transmitting knowledge. Thus, teachers’ use of appropriate strategies is a good intervention to promoting understanding of concepts that are being taught and eventually translates to good academic performance.

Davis and Glaser (1962) theorize a four-stage structure of teaching as cited in (Rajagopalan, 2020) as shown below :

Step 1: Planning of Teaching

This involves analysing the content to be taught, identifying and writing the learning outcomes to be achieved.

Step 2: Organisation of Teaching

This stage specifies the teaching strategies for achieving the teaching objectives stated.

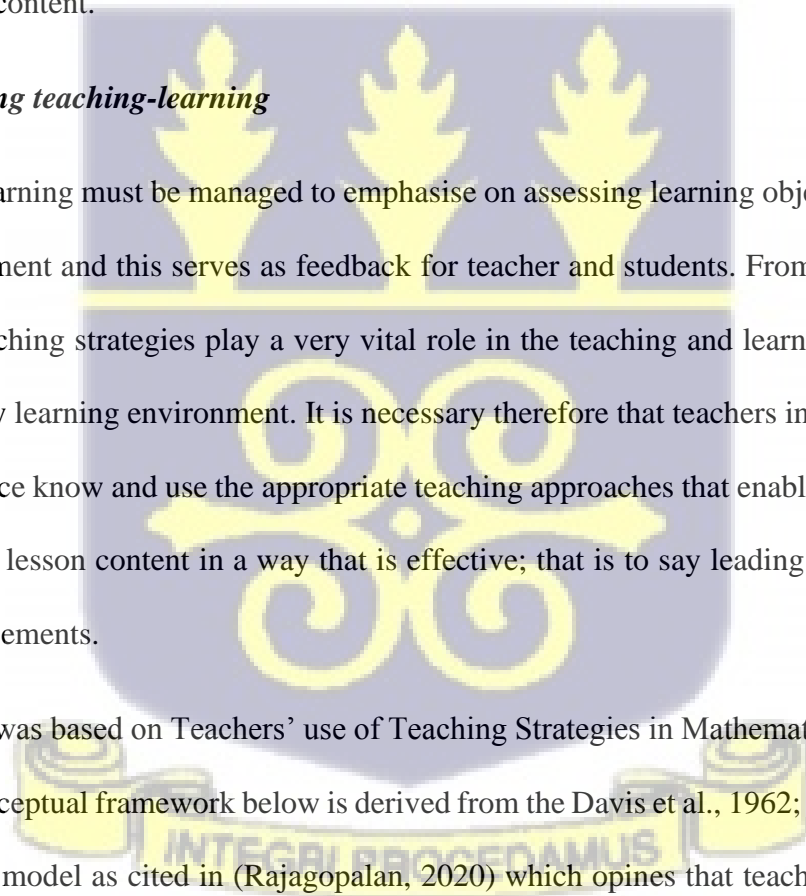
Step3: Identification of suitable teaching-learning strategies.

This involves teachers recognizing teaching and learning strategies that would promote effective transmission of content.

Step 4: Managing teaching-learning

Teaching and learning must be managed to emphasise on assessing learning objectives in terms of student achievement and this serves as feedback for teacher and students. From the above, it can be said that teaching strategies play a very vital role in the teaching and learning process in the classroom or any learning environment. It is necessary therefore that teachers in Mathematics and Integrated Science know and use the appropriate teaching approaches that enable them to transmit or communicate lesson content in a way that is effective; that is to say leading to students' good academic achievements.

Since my study was based on Teachers' use of Teaching Strategies in Mathematics and Integrated Science, my conceptual framework below is derived from the Davis et al., 1962; Gagne et al., 1974 and Gage, 1978 model as cited in (Rajagopalan, 2020) which opines that teaching strategy has a positive effect on student learning.



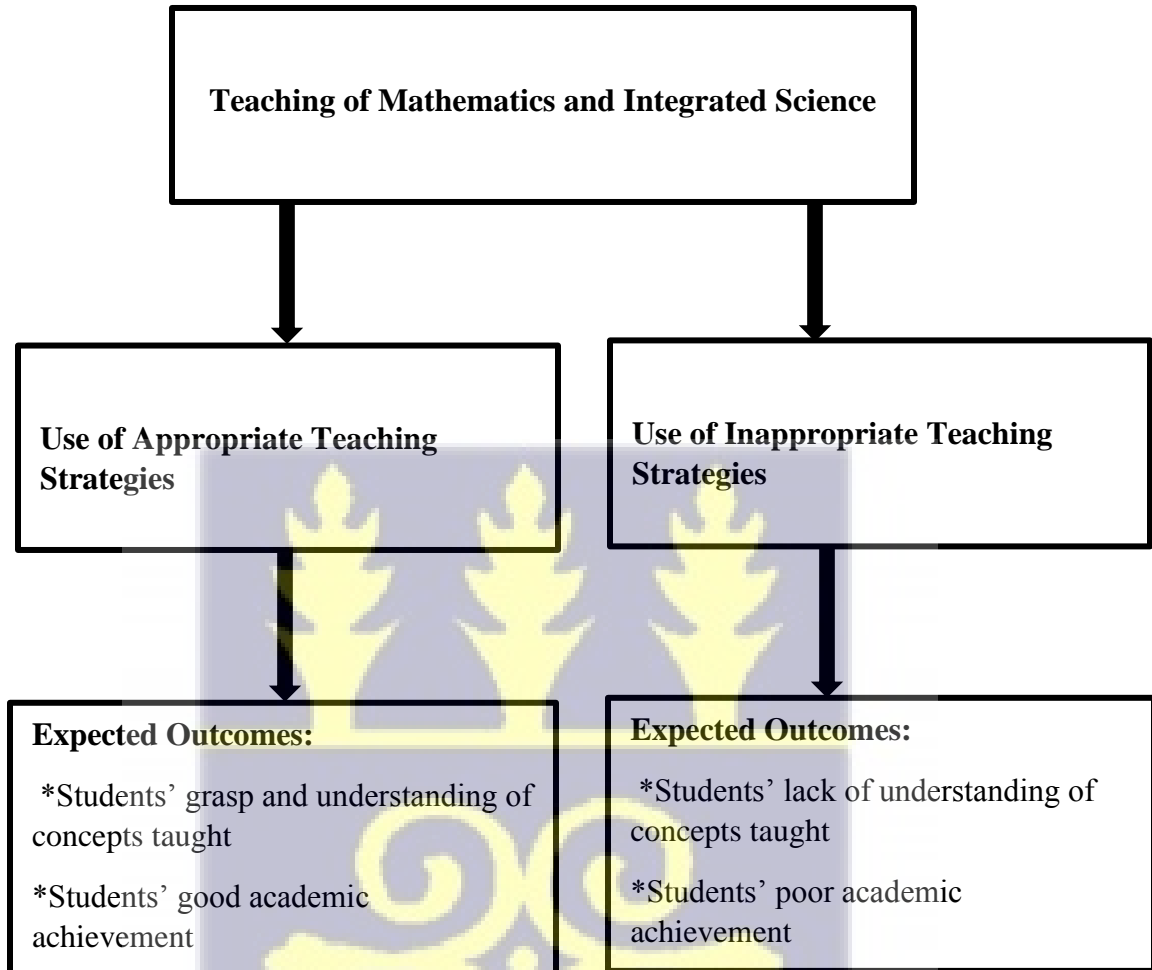


Figure 1: Conceptual Framework

Source: Researcher's own construct



As captured in Figure 1 above, Teachers' use of appropriate teaching strategies in teaching Mathematics and Integrated Science result in positive teaching outcomes. Students understand Mathematical and Scientific concepts that they are taught and it ultimately translates in good academic achievement not only in class, but also in standardised tests. On the other hand, when teachers use inappropriate teaching strategies in teaching these subjects, students find it difficult grasping concepts taught and this translates into poor academic performance in the subjects.

In summary, teacher's must make it a point to use teaching strategies which are appropriate for teaching their subject areas to enable students understand concepts taught in order to perform well in tests and examination. The above conceptual framework explains how using appropriate and inappropriate teaching strategies impact academic performance of students in Mathematics and Integrated Science.



2.2.1 Teaching Strategies

Teachers follow certain procedures and actions in the delivery of lessons with the aim of achieving particular learning outcomes. These procedures are known generally as teaching strategies. Other terms are used interchangeably to describe these procedures or actions such as teaching or instructional strategies. (Ibrahim, Musa & Idris, 2016) as cited in (Hassan & Ibrahim, 2018). Teaching strategies are a combination of teaching methods, which are a set of orderly procedures or techniques that follow a systematic way and focus to achieving learning outcomes. They have also been described as the process by which a segment of instruction, stage or a whole course is transmitted, or a sequence of teaching and learning modes or styles to promote attainment of a particular type of objective (Fajamidagba et al, 2012).

Teaching strategies are grouped into three (3) main categories; teacher-centred, student centred and teacher-student interactive methods and are suited for different learning environments, resulting in different learning outcomes (Ganyaufpu, 2013; Morrison, Morrison & Kalman, 2019). Educationists further classify teaching strategies into active learning, group-based learning, assessment-based learning and enquiry-based learning (IBL) (Illeris, 2018). These approaches are based on learning theories such as behaviourism, cognitivism and constructivism. Teacher centred theories have their roots in the behaviourism and cognitive theories, whereas the student centred and teacher student interactive methods have their bases in the constructivism learning theory (Tomie, 2010).



2.2.2 Teacher Centred Strategies

In this type of teaching, the teacher is an instructor, transmitting knowledge to students without engaging them with the subject matter. The teacher is seen as the one with command over what is being taught, whereas students are regarded as not having knowledge in the subject matter and have to be passive receivers of the knowledge being transmitted by teachers (van de Kuilen, Altinyelken, Voogt & Nzabwirwa, 2019). It is more theoretical than practical and involves memorisation and rote learning (Teo & Wang, 2000). Teacher centered methods are associated with inadequate stimulation of students, innovation and intellectual thinking, memorisation and cramming of facts and poor retention of knowledge (Tella, 2010). It does not apply much practical activity that stimulates learners to learn real life problems based on applied knowledge. The idea with this kind of method is to maximise the use of time and effort. This results in a lack of interest and understanding of students. Because this teaching strategy is solely about knowledge transmission, students' questions are expected to be answered by the teacher alone, instead of allowing students to express their views on questions and lessons taught (Di Biase, 2019). This does not allow students to develop creativity, critical thinking, communication and problem-solving skills as is required to navigate this modern world and the future.

Teaching and learning are based strictly on a determined curriculum; thus, success is achieved when the set curriculum is completed by the teacher. Assessments and examinations are based on this same curriculum.

This strategy is advantageous where there are large class sizes and limited resources and it is difficult to meet the learning needs of each individual student (Starkey, 2019). It is also the most preferable strategy because it encourages the use of shorter time periods for class activities. The teacher only has to prepare a single learning material to teach all students, and present lessons or

subjects in a logical manner such that the teacher is focused on what is to be taught for the day or period, what has already been planned according to the textbook or curriculum specifications.

The downside in using this strategy is its failure to promote a change in attitude of students, that is to say promoting effective student learning, which is a fundamental part of teaching, because the teacher is the only source of information. Students could also be motivated to actively source for knowledge on the subject matter being taught so they are not only passive receivers of information. There is also the lack of creativity and innovation, as well as a lack of opportunity to explore knowledge as a result of the rigid manner in which this strategy operates or is used (Di Biase, 2019). Thus, Zakaria and Daud (2010) suggest that teaching should not only be about giving out rules, definitions and procedures to memorise, but must actively engage students to be participants in order to gain their interest and understanding.

2.3 Student Centred Strategies

All over the world student centred strategies have received a lot of recognition and support as a lot of studies show that there is a higher learner performance with this strategy compared to the traditional teacher centred strategies (Li, Flowerdew, & Cargill, 2018; Day, Gu & Sammons, 2016).

Learner centered methods sees the teacher as more of a facilitator and engages students in the teaching and learning process (Olayinka, 2016). These strategies place the responsibility of learning on the student, the teacher only facilitates the process. The idea here is to help students develop skills that help them take charge of their own learning, that is, learn how to learn (Sakata, 2019). This strategy is constructivist based and interactive in nature, thus, promoting collaboration

or collaborative learning and building on previous knowledge. Here, questions are planned so as to encourage small group work. This leads to developing creativity, critical thinking and active participation of students in the process. This approach involves discussions, intellectual discourses which promotes retention, problem solving and increased performance (Dufresne, Gerace, Leonard, Mestre & Wenk, 2010; Chika, 2012) and categorized into broad methods such as inquiry based, problem based, project based, demonstration among others (Sakata, 2019). These methods make students goal oriented, making it very effective in improving students' achievement.

Learner-Centred methods have many advantages such as giving the individual learner a chance to participate, think critically and learn to communicate in the process. These learner-centred methods are useful when teaching complex academic content (McKnight, O'Malley, Ruzic, Horsley, Franey & Bassett, 2016) and also accommodates varied student learning styles while promoting active involvement of all students. Students are free to ask questions, lead discussions and define problems. These all go a long way to help students relate real life experiences with what they learn in the classroom. This way, they are able to share their experiences through their small group discussions, while practicalising what they have learnt in class which develops their critical thinking and communication skills and further arouses the curiosity and interest of students as well as developing analytical and research skills (Starkey, 2019).

According to Starkey (2019) because students actively engage in discussions, the classroom environment becomes disorganised and so the facilitator has the task of managing all these activities simultaneously as the students work on various stages of the same activity. There is also the possibility of students missing out on important facts and knowledge in the process because the strategy does not make room for teachers to deliver one standard lesson for all students at a go.

Also, for those students who have a preference to studying or working by themselves, this strategy is inappropriate since it relies heavily on collaboration and group activity.

2.3.1 Problem Based Learning (PBL)

Problem based learning centers on the student and it is commonly used in teaching Mathematics. It actively involves learners and stimulates learning and problem-solving skills. It is a teaching approach in which real life problems are used as the main basis for developing problem solving and self organisation skills (Kauchak & Egen, 2012). This method encourages students to share knowledge, develop ideas, search for information and develop arguments in support of solutions found (Sawyer, 2014). It begins with a problem; the teacher asks a question then organises the students to conduct research. The teacher guides them to do independent or group investigations and then facilitates discussions on findings.

Students who are taught with PBL method are in charge of their own learning (Major et al., 2000). With this method unlike the lecture method, students are not passive receivers of knowledge, but are free to explore and solve problems. It shifts the process from teaching to learning, through facing problems to be solved and gaining new knowledge that way instead of being bored.

2.3.2 Demonstration Method

Adekoya and Olatoye (2010) describe the demonstration method as working well with small and big groups alike, involving all the senses of the learner helping learners experience certain concepts for the first time, hence the need to encourage the demonstration method. It is one that is known

to challenge students to “learn how to learn” as they work co-operatively in groups (Duch, 2002). Demonstration is advantageous in that, it motivates students to learn, time and material saving and also teaching one how to avoid accidents. The downside with this method is it does not give learners the chance to explore on their own, also does not cover a large scope (Ameh & Dantami, 2012).

2.3.3 Inquiry Based Learning (IBL)

Inquiry Based learning (IBL) is one student centred method that has gained a lot of attention especially in science education. Here, students are engaged through research so as to construct knowledge (Keselman, 2003) as cited in (Pedaste, Mäeots, Siiman, De Jong, Van Riesen, Kamp, & Tsourlidaki, 2015). It is a process by which students develop new information through experiments or observations (Pedaste, Mäeots, Leijen & Sarapuu, 2012). This approach relies on problems or questions and the problem-solving skills of students. The learner discovers new knowledge through active participation in classroom activities, thus, learners learn by doing. IBL helps develop critical thinking and self-reflection or metacognition skills where the student acquire the ability to do independent inquiry and takes responsibility for their learning (Justice et al., 2007; Kahn & O'Rourke, 2004) as cited in (Pedaste et al, 2015). IBL is grouped into structured inquiry which the teacher poses a problem and gives the format for solving the problem. There is also the guided inquiry in which the teacher stimulates inquiry by asking questions for which students are left to explore the questions on their own to find solutions on their own. Open inquiry allows students to pose their own questions and do their own inquiry (Staver & Bay, 1987) as cited in (Spronken-Smith & Walker, 2010).

2.3.4 Project Based Learning (PjBL)

Project Based Learning is a method of teaching and learning in which learning is centred on projects. These are projects and tasks which are based on challenging problems and requires that students design products, solve problems, make decisions and engage in investigative activities. Engaging in these activities encourages students to work independently over long periods of time to come out with a product or presentation (Dado & Bademer, 2017) as cited in (Chen & Yang, 2019).

PjBL can be used in teaching many subjects; however, it has been found to be more useful in teaching Science (Rogers, Cross, Gresalfi, Trauth-Nave & Buck, 2011) and Mathematics (Han, Caprano, & Caprano, 2015; Holmes & Hwang, 2016) as cited in (Chen & Yang, 2019).

This approach helps students construct new knowledge (Oguz-Unver & Arabacioglu, 2014). Lenz, Wells and Kingston (2015, p. 68) opine that the underlying principle of PjBL is that “learning is more engaged when triggered by a student’s “I need to know” than by a teacher’s “because you should know.” What makes PjBL different from other teaching strategies is the involvement of projects and can be described as an “act of creation over time” (Lenz et al., 2015, p.67) which gives students practical experiences as they work with ideas from the curriculum, engage in group and peer discussions and presentations on their projects (Johnson, Renzulli, Bunch, & Piano, 2013). PjBL encourages students to learn while finishing the projects they embark on (Bender 2012) as cited in (Chen & Yang, 2019) as well as develop interest in curriculum content (Holmes, 2011). Also, students learn to be creative and think critically, while developing metacognitive skills (Chen & Yang, 2019).

Though this method has many positive attributes, concerns have been raised about the long hours involved in using this strategy, though it covers only few aspects of the curriculum content (Miller, 2018). To help make PjBL more effective, it has been suggested that teachers introduce the use of technology in their classrooms, such as internet friendly devices, computer-based simulations and other technological support. This gives further support to students with their project works, when doing their investigations and searching for needed information, while making communication and collaboration with their peers easier (Hung, Hwang & Huang, 2012; Krajcik & Czerniak, 2014). The introduction of technology in PjBL can lead to a new process of teaching and learning.

2.3.5 Cooperative/ Collaborative Learning

This is a constructivist learning approach that involves students agreeing for a mutual purpose (Gelici & Bilgin, 2011; Capar & Tarim, 2015). This method has been used at all levels of education and comes with many advantages. For example, it helps develop the cognitive abilities of students, challenges them to learn and ultimately improves their classroom performance. With this method, the student is able to achieve their learning goals through group work.

According to Gülec and Macan (2014), and Capar and Tarim (2015) students coming together to learn this way makes them more responsible for their learning whiles developing emotionally by building positive relationships because of the teamwork that they build as a result of this collaboration or cooperation with other students within the team. These group interactions help students build good social as well as learning skills which help them to contribute to their groups as well as the class, because each member of the group contributes to the common learning purpose

of the group, involving each learner actively in the process, whiles learning from their peers' things that they had difficulty understanding earlier.

Apart from all the advantages that have been highlighted above, some disadvantages exist such as some students or inability to work collaboratively with other students, as some may want to take over and act superior. Also, the noise that emanates as a result of group interactions could be problematic for other groups and even teachers. Again, the issue of assessment of students in a group can be tricky as it could be difficult measuring individual contribution of students in a group.

2.4 Teacher-Student Interactive or Integrated Method

This approach is a blend of teacher-centred and Student-centred methods that is based on the inquiry method (Chick & Hassel, 2009). It is designed to make students active by engaging them with activities that require that they explore, research, gather and process relevant information that they interpret and share their findings with other students. By so doing, students construct their own understanding or knowledge based on their previous knowledge, thereby gaining new knowledge in the process (Riordan, Hine & Smith, 2019). This approach helps teachers to stimulate students' interest, help develop their higher order learning skills such as analytical, research and critical thinking skills and enables them to generalise and transfer what they have learnt and also analyse, synthesise and apply what they learn (Ganyaufpu, 2013). Using this teaching strategy goes further to make students find relevant information about what they learn, unlike being subjected to a teacher being the sole transmitter of information. By adopting this strategy teachers can use a combination of approaches such as lecture and demonstrations and use audiovisual and PowerPoint presentations and even group discussions to achieve learning

outcomes. The strategy captures many learning styles and allows for the use of real-life situations to involve all students in the teaching and learning process, as well as creating positive collaborative learning environments (Day et al., 2016) as cited in (Akrofi Baafi, 2020). This goes a long way to promote deeper content grasp and understanding. According to Riordan et al. (2019), using this strategy means combining different kinds of information resulting in high cognitive load that could be too much for students to bear. This could also mean that students would have to plan their cognitive resources such that they are able to utilise all information or knowledge gathered in the process of learning (Drinkwater, Gannaway, Sheppard, Davis, Wegener, Bowen, & Corney, 2014). Students with low levels of knowledge about concepts are likely to be overwhelmed if they are given the same tasks with those with higher levels of prior knowledge on the given task. An integrated learning environment could also lead to differentiated learning because not all students in this environment would be able to store and retrieve information promptly (Riordan et al., 2019).

2.5 Teaching Strategies and Academic Performance/ Achievement

Academic performance or achievement of students is the main aim of every teaching and learning process and features prominently in education (Rono, 2013). It is used as a yardstick or measure of how successful or otherwise educational institutions are and also, an assessment of knowledge gained through an educational programme using marks by a teacher, academic goals set by teachers and students, and are expected to be met at a specific time and measured through continuous assessment and standardised examination results (Narad & Abdullah, 2016). It is the basis for acquiring knowledge and learning important skills, values and attitudes needed by students to contribute to the development of their nations and also navigate in the 21st century and beyond (Malik & Singh, 2016; Farooq, Chaudry, Shafiq & Behanu, 2011). Students or learners

are expected to grasp concepts being taught so they are able to perform well in subjects and examinations, especially in standardised ones. The above expectations notwithstanding, standards of performance have been falling over the years and has been attributed to many factors such as parent, school, teacher, age and gender. For instance, in Ghana, BECE performance has been falling since 2008. Performance at the BECE dropped from 62.16% in 2008 to 50.21% in 2009, decreasing again from 49.12% in 2010 to 46.93% in 2011 (WAEC, 2012). Again, the WAEC Chief Examiner's report of 2015 revealed that candidates failed in one or more core subjects such as Mathematics, Integrated Science and English Language and could not be placed into Senior High Schools via the Computerised School Selection and Placement System (CSSPS).

The Trends in International Mathematics and Science Studies (TIMSS) report of 2013 recorded a poor performance for Ghanaian science students who ranked 46th on the international front in science. According to the report, 13% of students achieved the low benchmark, with another 3% reaching the intermediate benchmark. This means that 80% of the students did not achieve the low international benchmark let alone any of them reaching the high or advanced level benchmark. This result only goes to show that most Ghanaian science students do not have a firm grip on scientific concepts because of poor knowledge of basic facts (TIMSS, 2013) as cited in (Ameyaw-Baah, 2018).

Again, an analysis of an earlier TIMSS report in Mathematics by Anamuah-Mensah and Mereku (2005) showed that Ghanaian JHS 2 students performed abysmally. Also, an assessment of Ghanaian students at the TIMSS showed a mean score of 276 compared to the international average mean score of 467 (Anamuah-Mensah, Mereku & Asabere-Ameyaw, 2005) thus, out of 46 participating countries Ghana ranked 45th.

Similar results were reported in 2007 and 2011 as the scale scores of 130 and 430 in 2007 were below the average score of 500 and 800 (Anamuah-Mensah, Mereku & Ghartey-Ampiah, 2008). In view of the above poor achievement in the subject, educationists have recommended that students must be made to understand the importance of Mathematics to Ghana's educational system (Chief Examiner's Report, 2011).

Academic achievement in Mathematics and Science remains an important issue worldwide as they are crucial to the development of 21st Century skills needed to navigate the fast-growing world and provide solutions to the real-life problems facing the world today. Without a good foundation and grasp of scientific and mathematical concepts right from the basic level, achieving the above would be next to impossible, yet Science and Mathematics achievement seem to be falling in recent years. This has led to calls for a look at the way these core subjects are taught right from the basic level. It has come to the fore that students in these subjects lack a strong foundation and understanding of scientific and mathematical concepts for many decades and has been attributed to the fact that the subjects are not taught in a way that helps students practicalise concepts taught, that is, they are not taught in a way that helps them relate what they have been taught to real life experiences thus making it abstract and difficult to understand and apply them as expected or when need be in examinations (Anamuah-Mensah & Benneh, 2006) as cited in Ameyaw-Baah et al., 2018).

In view of the above, many advocates have proposed the use of constructivist approaches to teaching these subjects to promote understanding of concepts taught and development of higher order learning skills and other skills which would go a long way to enhancing or positively enhancing student attitudes towards learning the subjects and ultimately performance. These approaches are known to equip learners with the ability to acquire and apply new knowledge which

they construct in the process of learning to real life situations (Daluba, 2013). It further helps them to explore, analyse, communicate and ask questions in the process, thus, developing their skills and abilities in Mathematics (Turnuklu & Yesidere, 2007) as cited in (Assuala, Yakubu, Asiedu-Addo & Arthur, 2016).

Using Constructivist methods in teaching Mathematics for instance changes the process of teaching and learning the subject from the teaching of concepts and formulae that seem abstract to using innovative ways of linking Mathematics to real life situations and problem solving (Vintere, 2018). This approach also helps students develop personal mathematical ideas as well as finding their own means of solving problems through encounters with these problems either individually or with their peers (Clements & Battista, 2009).

Additionally, Mathematics must be made to allow opportunities for active engagement of students in lessons through problem posing and solving in the classroom (Fredua-Kwarteng, 2005) as cited in (Mereku, 2010). The classroom must be organised into a learning community with the main aim of solving problems. These problems when asked are not directed only at the teacher but the whole community including the teacher, who discuss these problems together and are also allowed to ask questions and express their views and ideas whether right or wrong without any inhibitions. This way students solve problems as a community through their academic discourses and learn from each other in the process. This leads to better understanding of concepts, development of higher order competences and good performance in the subject (Mereku, 2010).

To help develop scientific skills of students it is suggested that teaching the subject must be more activity inclined. Also, the adoption and inculcation of solving real-life problems in the teaching and learning of Science in the classroom must be considered as this this will go a long way to boost the interest of students in the subject, aid understanding of concepts as students are engaged in

hands-on experimentations, thus solving problems, being creative and constructing their own meanings which translates into good academic performance (Poon, Tan & Tan, 2009) as cited in (Ameyaw-Baah et., al, 2018).

Teachers are now shifting from teacher centred methods to learner centred methods of instruction to enable students explore and discover facts in science and find solutions to mathematical problems by themselves (Hassan & Ibrahim, 2018).

In Ghana for instance, there have been many suggestions by educationists to take another look at how Science is taught right from the basic level as a way of improving students' Science and Mathematics achievements (Danso, 2010) as cited in (Ameyaw-Baah et al., 2018).

The Ministry of Education in Ghana has developed a new format for the teaching of science with the inquiry approach as the main basis for instruction in the subject. This is in an effort to improve the teaching and learning of science especially at the basic level and developing the interest of students in learning science as a source of knowledge, as well as developing skills such as critical thinking, problem solving, research and analytical skills among others and even lifelong learning (Ameyaw-Baah et al., 2018).

According to Abdullah, Tarmizi and Abu (2010), Problem Based Learning (PBL) has been found to have a positive effect on students' mathematics performance as it helps students understand and explain mathematical concepts better. The method is said to get students better engaged in teaching and learning activities that lead to higher performance scores, and better teamwork.

Zakaria, Chin and Daud (2012) also discovered that co-operative learning had better effect on academic achievement in Mathematics. Here, the main aim of students is to put their abilities together with the main aim of solving problems that had been posed to them. Also, with this

method, students are able to learn from each other, transfer knowledge to each other by sharing what they know with each other at the peer level which makes understanding of concepts easier to achieve, this then translates in academic achievement not only at the group level but individually.

Action learning, a teaching method in which students work on solving real life problems and reflecting on their solutions with the supervision of a more knowledgeable person has been recorded as another effective way of teaching Mathematics. This method can be applied at all levels of education and uses a hands-on or practical approach instead of resorting to the use of traditional methods like lecture and rote learning, thereby motivating students to learn the subject. Using this approach helps students find different ways of solving problems while learning particular problem-solving strategies which they previously had to grapple with (Vintere, 2018).

Inquiry Based Learning (IBL) has also been found to be highly effective than traditional methods on learning performance of students (Vlassi & Karaliota, 2012) . Inquiry Based Learning when used in teaching science students engages students in various activities that stimulate their cognitive processes and enables them gather relevant information, solve problems in a logical manner based on facts they have learnt by themselves through their inquiry. Their research and analytical skills are also developed as well as the promotion of their understanding and practical application of concepts. It further promotes students' interest in the learning of science whiles leading to high academic performance in Science (Secker, 2002) as cited in (Abdi, 2014).

Outdoor learning is another teaching approach that has been found to be effective when it comes to the teaching of science. This form of learning exposes students to the environment outside the formal or traditional classroom, and keeps students actively engaged in the learning of science by giving them tasks that make them interact and learn from the outdoors (Dhanapal & Lim, 2013). This way students' academic performance in science is improved as they actively participate in

learning, through these experiences with the outdoors and construct their own meaning and understanding which they are able to reproduce in tests and exams while also applying these to their day-to-day experiences.

2.6 Theoretical Review

The underlying theory for this study is the constructivism theory which is one of the theories of teaching and learning. It is one of the pedagogical theories that has made tremendous impact on teaching and learning because of the ability to adopt it into educational strategies.

2.6.1 Constructivism Theory

The Constructivism theory of education was developed by Lev Vygotsky a post-revolutionary Soviet psychologist which according to Elliot (2006, p.256) as cited in (McLeod, 2019) is “an approach to learning that holds that people actively construct or make their own knowledge and that reality is determined by the experiences of the learner.” It believes that cognitive functions come about as a result of learners personally constructing their own meaning through prior experiences in interaction with new events.

The theory believes that learning is an active process rather than a passive one in which learners are seen to have no knowledge and thus must be filled with knowledge. It rather argues that learners can gain knowledge through active engagement with their environment. For example, learners would be encouraged to do experiments in science or solve Mathematical problems to gain this experience or understanding and knowledge. This is because learners may receive knowledge

passively as in a teacher-centered approach to teaching for example, a lecture, but for them to gain understanding they must be actively engaged to enable them to connect their prior knowledge with new ones and the learning process (McLeod, 2019).

According to Dewey (1938) “education must not be a telling and being told affair, but an active and constructive process” which is done through interaction instead of an abstract concept, that is, co-constructing knowledge socially or with others Dewey (1938) as cited in (McLeod, 2019). Cognitive development comes about when there are social interactions from guided learning based on what learners know and co-constructed knowledge with their peers (Vygotsky,1978).

Thus, learners must be actively engaged with teaching methods that make them experiment and solve real life problems. Using learner centred and teacher learner interactive methods such as discussions, collaborative, peer tutoring, demonstration, problem based, inquiry learning for example are a good way to help students make meaningful connections between prior knowledge, new knowledge and the processes that are involved in learning. Here, the teacher guides classroom activities in a way that supports students’ prior ideas or knowledge so they can build on them. This approach makes teaching effective because, acting as facilitator, the teacher directs his guidance to learners’ level of understanding, demonstration and giving hints whiles adapting teaching materials and activity (Oliver, 2001, Copple & Bredekamp, 2009) as cited in (McLeod, 2019). Individual learners may have their subjective ideas and learning history; however, they can benefit from each other’s knowledge through sharing of common knowledge and through this, upgrade their knowledge as they gather new knowledge and interpret it to suit them (Fox, 2001).

Thus, it is important to engage learners with methods that promote this social interaction such as co-operative or collaborative learning and discussions so they are able to interact with each other and learn from each other.

Various studies have shown that the constructivist approach to teaching Mathematics and Science impacts the teaching and learning of these subjects. For instance, with Mathematics, it connects it with everyday experiences instead of teaching abstract formulas and embracing a creative approach to solving mathematical problems (Vintere, 2018).

The same goes for science teaching where constructivist strategies are encouraged for promoting students' active involvement in lessons while improving their academic performance (Dhanapal & Lim, 2013) as cited in (Hassan & Ibrahim, 2018). This is because gaining knowledge depends on interactions between a learner's environment and their innate characteristics which help them gather and interpret their own understanding (Vintere, 2018).

2.7 Empirical Review

One of the studies investigating the effectiveness of teaching methods and how they affect academic performance of learners was carried out by Ganyaupfu (2013). The objective of the study was to find out the differences in effectiveness of teaching methods on students' academic performance, focusing on teacher-centered, student-centered and teacher-student interactive methods. A sample of 109 undergraduate students were used, and the data was analyzed using inferential statistics. The findings were that teacher-student interactive methods made the most impact, followed by student-centered methods, with teacher centered methods being the least effective. The findings prove that teacher-student interactive and student centred methods gives students the engagement and interactivensess they need to construct their own understanding of concepts. That involvement enables them understand and express themselves in their own way which the teacher centred approach does not offer them.

Another study was conducted by Martin, Laciste and Concepcion (2019) with the purpose of determining the impact of modern teaching method in the teaching learning process. A questionnaire was used as the data collection instrument, using the descriptive-quantitative method. Frequencies, percentages and weighted mean were used to treat the data. The target population was two hundred and eighty-six (286) senior high school students at the University of La Salette, Inc.- Santiago City during the school year 2018-2019. Some of the modern methods used were practice based learning, inquiry-based learning, brainstorming and computer-based learning. The findings were that modern teaching methods have a positive impact on the learning of students and lead to lifelong learning. Also, the study revealed that among the four teaching methods, brainstorming is the most effective for students' learning. Following the findings and conclusions of the study, teachers were encouraged to continually adopt a method of teaching that will help their students learn easily meet and satisfy the needs of the students. Thus, teachers are encouraged to always reflect on their own methods to improve the teaching learning process. Also, in choosing an appropriate teaching method, teachers should consider subject matter and students' level and abilities. Brainstorming may not always be an effective method in the teaching and learning process thus, before teachers use any teaching method, they must test for its effectiveness. The positive impact recorded with these methods can be attributed to the fact that these methods promote learning through practice, experiment, observation which develops their research and analytical skills. The hands-on experiences is what makes these methods impact positively on student understanding and performance. Brainstorming also helps students to develop their own ideas on concepts being taught and have the boldness to share or communicate what they know with each other.

Another study carried out in Kenya looked into teaching practices and their effects on learners' achievement was carried out by Ngware, Oketch and Mutisya (2014). The study focused on low and high performing schools in Kenya. The researchers hypothesized that teaching style plays a key role in explaining the differences in academic achievement between primary schools. The researchers collected and analysed information from 72 recordings of mathematics lessons in 72 primary schools in Kenya. The key finding of this study and implications for policy were that students learning achievement can be greatly improved through quality teaching even though some conditions such as class size are not conducive.

These findings go further to support the fact that having good teaching practices such as using teaching strategies are central to promoting good performance of students. When strategies and the right methods are used, students would experience change in terms of learning and understanding concepts, though meeting conditions such as teaching and learning in decent and good settings also help motivate students to learn.

A Study by Karami, Pakmehr and Aghili (2012) examined the effect of collaborative learning on the development of critical thinking skills in high school learners. The study focused on all high school male students of Farima-Khorasan Razavi in the 2011 academic year, using multistage cluster sampling. One high school out of three was selected randomly then from three stages of that high school, one was selected using 26 students as the experimental group in a pre-and post-test study. The findings showed that applying collaborative methods during classroom discussions and other social interactions, such as criticism increased the students' inclination towards critical thinking. The collaborative method also increased the students' motivation to be creative and innovative. It can be said that using the collaborative methods developed students critical thinking

skills compared to traditional teaching methods. Collaborative methods challenge students more cognitively than teacher centred methods in that students have the opportunity of stretching their analytical and problem-solving abilities when they are left on their own to learn with their peers, unlike being spoon-fed by teachers as found with the traditional methods.

A study done in Ondo, Nigeria on Senior Secondary School students, found out that students exposed to the word problem teaching strategy model performed significantly better in Mathematics than their counterparts in the control group. The study looked at the effects of instructional strategies on Senior Secondary School (SSS) students in Mathematics word problems with a selection of one hundred and twenty-five (125) SSS 2 students by purposive sampling from two schools. The study used quasi experimental design. Based on the findings, it was recommended to other Mathematics teachers to adopt the use of instructional patterns in teaching Mathematics in secondary schools (Fajemidagba et al., 2012).

It can be said that using word problems make students analyse problems posed to them in the course of teaching and learning and this stretching of their cognitive abilities makes them find ways of solving mathematical problems hence their significantly better performance in the subject.

One other study into teaching methods and their impact on student achievement was conducted by Cordero and Gil-Izquierdo (2018). The aim of their research was to explore the impact of different teaching strategies on student performance, specifically differentiating between modern active learning and traditional teaching focusing on lecture, memorising and repetition. Data from fourteen (14) countries that participate in the well-known educational survey worldwide that is, the Programme for International Students Assessment (PISA). Their choice of teaching strategies was based on information gathered directly from teachers' responses given by teachers in the same school. Their empirical analysis was based on data provided by PISA 2015, which for the first time included a

questionnaire completed by teachers about their background and instructional activities. The findings showed that, both traditional and modern strategies have a positive impact on students' science achievement, however, they realised that the impact of the former is clearly more relevant, and that, the positive effect of modern strategies was found mostly among high-achieving students. These findings have important policy implications for the design of educational policies as they prove that previous conclusions reached in other studies using data about activities conducted by individual teachers, although most of them only referred to a single country.

Ali, Akhter and Khan (2010) researched into the effect of problem-solving method on mathematics students. The objective of the study was to investigate the effects of problem-solving methods on students' achievement in mathematics in elementary schools. The pre-test and post-test design was used. The sample for the study was seventy-six (76) eighth grade students who were selected by random sampling and divided into two groups of 38. One group was used as the experimental group and the other the control group. The control group was taught using the conventional methods of lecturing and questioning from textbooks, while the experimental group was taught using problem-based method where students were further divided into groups to solve problems. The results showed that, adopting the problem-solving method improved students' achievement in mathematics as compared to traditional methods. The study recommended that teachers should use problem solving methods in teaching mathematical concepts because they helped students to better understand concepts leading to better performance of students in mathematics. This study further proves the effectiveness of problem-solving method in teaching Mathematics and must really be enforced in the teaching of the subject for better results.

In Kenya, another research looking into teachers' use of teaching methods and their impact on academic performance of learners was conducted by Akama (2015). The study sought to

investigate teaching strategies adopted by science teachers and how they impacted academic performance of learners in science in public schools in Kenya. It also sought to find out the reasons behind science teachers' preference for these strategies. The target population was 30 public primary schools, 650 teachers and 20,733 pupils. Six schools were finally selected and 130 teachers interviewed, using a questionnaire as the main research instrument. The findings of the study were that inquiry method was the most used method by science teachers, though experiment method was identified as the most effective for teaching science. The reason for the science teachers' choice of these strategies were that they did not have the needed teaching and learning resources to enable them to use the right strategy to teach and improve students learning of science. The findings of the study is a call for educational stakeholders to ensure that teachers have the needed resources to enable them use the appropriate strategies and methods for teaching to ensure understanding of concepts as well as good academic performance in the subject.

Adekoya and Olatoye (2011) studied the effects of three teaching strategies in science education, that is agricultural science namely, demonstration, peer-tutoring and lecture. The lecture method was used as the control method as it is known to be the most popular method of teaching. 150 Senior Secondary School agricultural science students were drawn from three schools, and a pre-test, post-test experimental design and a control group. Findings were that students performed significantly at different levels in the three schools.

Demonstration and peer tutoring methods were found to be the best methods for increasing student achievement. This is because, peer tutoring a progressive peer facilitated teaching strategy, used student partnerships in which high and low performing students were paired or put in groups so as that the high performing students could teach the low performing ones, while the low performing ones also learnt from the high performing students. Demonstration is also useful in science

education because of its practical involvement and hands on approach, where a teacher demonstrates by performing an activity and students learn by following the teacher's actions or demonstration. Findings were that peer tutoring and demonstration strategies lead to cooperation and create pleasant environments where peer relations are fostered and goes a long way to increase academic achievement of students.

A study was done by Bamidele in 2020 with the objective of evaluating the effectiveness of two student-centred methods of teaching as compared to traditional instructional methods on tertiary education students. It sampled 192 level 200 students drawn from various colleges of education in South-West Nigeria. Data Collection instruments were a collaborative learning guide and individualised instructional strategies guide. The findings were that there is a significant difference on the effectiveness of the three teaching methods (Collaborative, individualised and conventional or traditional learning methods). It revealed that, collaborative learning was the most effective teaching strategy followed by individualised instructional techniques. Thus, there is a difference in performance of higher institution students taught with collaborative and individualised instruction as compared to conventional instructional methods. Per the finding students must be encouraged to work together to promote the pooling of academic resources or knowledge to enhance student understanding of concepts and also improve academic performance of students.

One of the studies that investigated the impact that teaching strategies have on the academic achievement of science students was done focusing on engineering education. The objective of the study done by Giridharan and Raju in 2016 was to assess the impact of teaching strategies on students' academic achievement especially demonstration-based strategy using working models and lecture methods. The experimental research design was used. A sample size of one hundred and forty-four (144) students were selected and divided into four groups of thirty-six (36). The

demonstration method was found to have a more significant effect than the lecture method, that is demonstrating significant impacts on academic achievement among engineering students. Demonstration as a method gives students practical experiences of seeing and doing whereas lecture just describes and so can easily be forgotten and does not promote meaningful learning.

A Study by Karami, Pakmehr and Aghili (2012) examined the effect of collaborative learning on the development of critical thinking skills in high school learners. The study focused on all high school male students of Farima-Khorasan Razavi in the 2011 academic year, using multistage cluster sampling. One high school out of three was selected randomly then from three stages of that high school, one was selected using 26 students as the experimental group in a pre-and post-test study. The findings showed that applying collaborative methods during classroom discussions and other social interactions, such as criticism increased the students' inclination towards critical thinking. The collaborative method also increased the students' motivation to be creative and innovative. It can be said that using the collaborative methods developed students critical thinking skills compared to traditional teaching methods.

In Ghana, Ameyaw-Baah, Amoah, Annafo and Assem (2018) conducted a study to ascertain if there were any differences between the effects of enquiry-based learning methods and traditional methods of teaching Science on the performance of JHS 2 students. Using quasi-experimental and action research methods under mixed methods design, they selected thirty (30) JHS 2 science students through purposive sampling from two schools. The sample was further split into two groups, one being the experimental group which was taught using enquiry-based learning methods and the other, the control taught using traditional teaching methods. Data collection instruments were Science Knowledge Assessment and Engagement checklist. Differences were found in the

performance of the experimental group which was taught using the enquiry-based methods and students of the control group taught by traditional methods. The experimental group were found to perform better than their counterparts in the control group which was attributed to the fact that the experimental group was better engaged in lessons thus, understood and constructed their own meaning as they made their own discoveries from which they made deductions or drew conclusions and were able to share their findings. Additionally, they developed research, analytical, communication and problem-solving skills among others. It was thus recommended that the enquiry-based methods be adopted to teach science at the JHS level. Using the enquiry method surely has impact in developing skills needed to improve students' knowledge and performance in science whiles developing 21st Century or higher order skills.

2.8 Chapter Summary

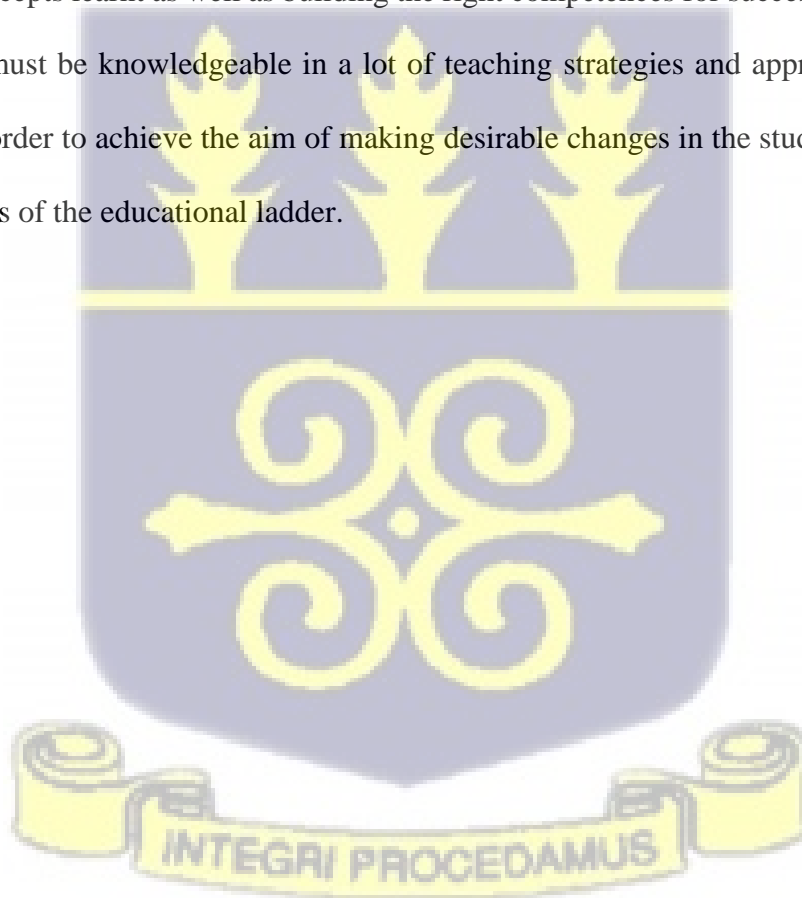
The chapter looked at teaching strategies and its effects on academic achievement and performance in general and then in relation to Mathematics and Science specifically. It first considered conceptual and theoretical reviews of the study, followed by a definition of teaching strategies and the main categories of teaching strategies. The pros and cons of these strategies were also discussed, touching on some examples from the categories discussed.

Teaching strategies and academic achievement was looked at talking about teaching strategies that were found to be appropriate and effective in teaching Mathematics and Science and how these strategies apart from promotion of understanding of concepts through interaction and active involvement of students in the teaching and learning of these core subjects.

Also, it was realised that using these strategies help develop higher order skills and competences as well as developing metacognitive and life-long learning needed to help students solve real-life problems and ultimately perform well in formative and summative assessments.

The chapter ended with an empirical review of the literature on the use of teaching strategies and their effects on the performance of students. The review showed that the right application of teaching strategies or approaches is very important at every level of education, and this coupled with considerations of subject and concepts to be taught must be made to engage students in the teaching and learning process in order to achieve the right outcomes in terms of understanding and applying the concepts learnt as well as building the right competences for success in subject areas.

Thus, teachers must be knowledgeable in a lot of teaching strategies and approaches and apply them rightly in order to achieve the aim of making desirable changes in the students they teach at the various levels of the educational ladder.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter looks at how the study was conducted in relation to Mathematics and Integrated Science teachers' use of teaching strategies in Junior High Schools in Accra based on the following research questions:

1. What teaching strategies do Mathematics teachers use in teaching JHS students in Accra?
2. What teaching methods do Mathematics teachers use in teaching JHS students in Accra?
3. What teaching strategies do Integrated Science teachers use in teaching JHS students in Accra?
4. What teaching methods do Integrated Science teachers use in teaching JHS students in Accra?
5. What are the supposed appropriate teaching strategies and methods that are used by teachers to teach Mathematics in Junior High Schools?
6. What are the supposed appropriate teaching strategies and methods that are used by teachers to teach Integrated Science in Junior High Schools?
7. What are the results of teachers' use of these appropriate teaching strategies and methods on the performance of students in Mathematics and Integrated Science in Junior High schools in Accra?

This is followed by a review of the research design, the study area, population, sample, sampling techniques and data collection instruments. Finally, it describes the data collection and data analysis procedure.

3.2 Research Approach

The research paradigm for this study was the Constructivist paradigm, hence, the qualitative research approach was used in conducting the study since the research was a Case study. Because the study required an in-depth exploration into teachers' use of teaching methods, the research approach deemed appropriate was the qualitative approach. According to Creswell (2008), the qualitative approach provides the researcher the opportunity to interact with the participants as data is collected. This affords the researcher the opportunity to gather in depth and firsthand information that would help answer the research questions for the study (Creswell, 2008).

Also, it is believed that individuals construct their knowledge differently because of the subjective nature of knowledge (Neuman, 2000). Getting participants' individual views is important; thus, this approach gives the opportunity for participants to express their views, perceptions and experiences, which were gathered and analysed.

3.2.1 Research Design

Case Study was adopted as the research design for this study as the fundamental goal of case study design is conducting in-depth analysis of an issue, within its context with a view of understanding the issue from the perspectives of participants' and get close to them in their natural setting as in any form of qualitative research. (Creswell, 2014, Yin 2014). In qualitative approach, strategies of inquiry

such as narratives, phenomenologies, ethnographies, grounded theory studies, or case studies are employed (Creswell, 2014).

Since the aim of this current study was to explore the teaching strategies in terms of teaching methods and approaches that Junior High School (JHS) Mathematics and Integrated Science teachers use in teaching their students, data had to be collected from participants to ascertain these strategies, since they were in the best position to share their own experiences, hence the use of Case Study for the research.

The idea behind this research design was that in case study, the researcher seeks to explore and present participants' perspectives and experiences and gets close to them in their natural setting as in any form of qualitative research. This design supports the use of interviews and observation which this study used in collecting data from participants to enable the researcher to answer the research questions for the study. This design suits this study because the study sought to elicit from teachers their own perspectives on their use of teaching strategies in teaching these subjects and how they affect performance of their students.

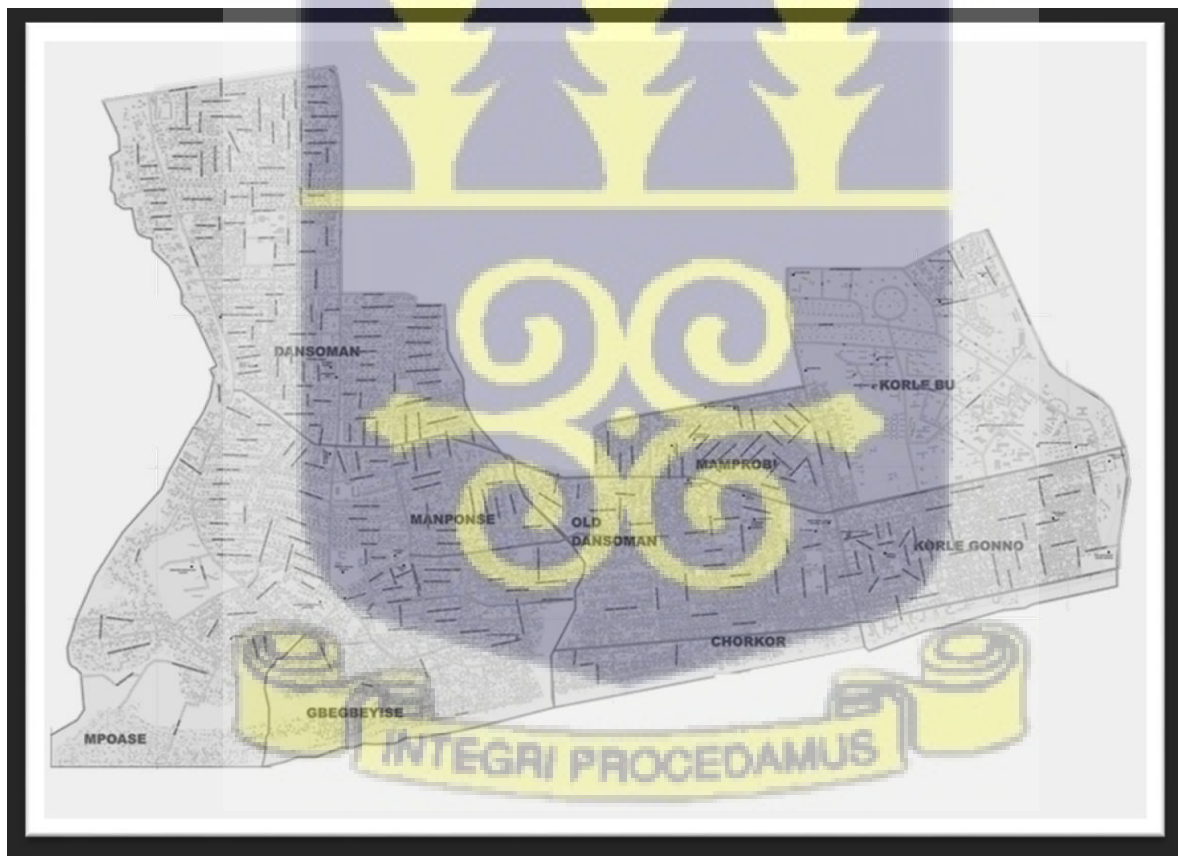
3.3 Study Area

The study was carried out in the Ablekuma South Sub Metropolitan District, which is one of the three Sub Metropolitan District Councils in the Accra Metropolitan Assembly. The Sub Metro is the biggest in the Metropolis and is bordered by Ablekuma North Municipal Assembly, Ablekuma Central and Ashiedu Keteke Sub Metropolitan District Council and covers an area of 15.1 square kilometres. According to the 2010 housing census, the sub metro has a population of 257,543. The sub metro contributes immensely to the economic development of Accra with its dominant

economic activity being fishing and fish mongering because most of its communities are dotted along the coastline. It can however boast of some business entities like supermarkets, banks, fuel stations, educational institutions and hotels.

This study was carried out in this area as it is representative of Junior High Schools in the Accra metropolis, which the researcher sought to study comprising a high population of both private and public Junior High Schools. The Educational Directorate has three (3) circuits in the Ablekuma South Sub Metropolitan District.

Fig 2: Map of Ablekuma South Sub Metropolitan District (Study Area)



3.4 Population

Johnson and Christensen (2012) describe a population as a group of elements, which could either be persons or items with common or similar characteristics, that are established by a researcher from which they want to make generalisations of a sample. Ary, Jacobs and Razavieh (2002) also look at the population as the entire group of people to which the results of a study apply. For the purposes of this study, the population was therefore all teachers of Mathematics and Integrated Science in the Ablekuma South Sub Metropolitan District of the Greater Accra Region where the study was delimited to, comprising ninety-six (96) Mathematics teachers and eighty-five (85) Integrated Science teachers.

Details per circuit are shown in Table 1 below:

Table 1: Junior High Schools in Ablekuma South Sub Metropolitan

CIRCUIT	PUBLIC	PRIVATE	TOTAL
KORLE GONNO	9	9	18
MAMPROBI	7	22	29
OJOO	11	10	22
OVERALL TOTAL	27	41	68

Source: Offices of Circuit Supervisors

3.5 Sample Size

A sample is a part taken from the population to study (Johnson & Christensen, 2012). It is also said to be a carefully selected part or subset of the unit that form part of the population. There are

sixty-eight (68) Junior High Schools in Ablekuma South District of Accra where the study was carried out, purposive sampling was used to select ten (10) schools for this study comprising five (5) public and five (5) private schools. Using this sampling method enabled me select participants who have experiences with the topic under study (Creswell, 2013). The sample for the study comprised twenty (20) teachers in all from public and private Junior High Schools in Accra, drawn from the Ablekuma South District who teach JHS Mathematics and Integrated Science. The participants' were made up of eighteen (18) males and two (2) females. This representation of participants is not deliberate on the part of the researcher. It just happened that this was the actual situation on the field when data was collected from the selected schools. Ten (10) JHS teachers per subject both male and female who had taught the subjects for at least one year were selected within the district. This sample is representative enough for a qualitative study and allowed for the collection of in depth and rich information for analyses (Turner, 2010 ; Creswell, 2013).

Table 2: Population and Sample Size

CIRCUITS IN DISTRICT	NUMBER OF SCHOOLS	PUBLIC SCHOOLS SAMPLED	PRIVATE SCHOOLS SAMPLED	TOTAL OF SCHOOLS SAMPLED
KORLE GONNO	18	1	1	2
MAMPROBI	29	2	2	4
OJOO	22	2	2	4
OVERALL TOTAL	68	5	5	10

3.6 Instruments for Data Collection

For this study, I found the use of semi-structured interview guide and an observation checklist more appropriate, as they are a way of eliciting rich, detailed information about participants experiences and views on a particular matter (Turner, 2010), thus, with a semi-structured interview guide and an electronic audio recording device, I interviewed participants face-to-face individually which I recorded for later transcription and analysis.

The interview guide had a set of questions on the topic of study which were asked in sequence and offered the researcher the opportunity to change the sequence or wordings and time allocated to each question based on the requirements of each interview.

Interviews are a valuable method of gaining insight into people's perceptions, understandings and experiences of a given phenomenon and can contribute to in-depth data collection. The semi structured interview was used for this research because the researcher had some knowledge in the area of study, that is teaching strategies that are supposedly appropriate for teaching the subjects under study and so the semi structured interview allowed for flexibility within the interview so in-depth information could be collected from participants (Jacob & Ferguson, 2012; Bernard, 2017). Using semi structured interviews also offered the researcher the opportunity to ask additional questions for clarification and also allowed me to collect detailed information about the research questions (Chenail, 2011).

Observing the teaching of the participants also enabled me ascertain firsthand what the participants' teaching methods are to confirm what they had told me in the interviews.

3.7 Validity and Reliability of Instrument

Validity and reliability are a very important part to the findings of every study. It is the extent to which a study represents what it was intended to research accurately (Charmaz, 2006).

Ary, Jacobs and Razavieh (2002), also opine that validity determines whether an instrument measures what it is supposed to measure.

To check for validity a draft of my eight (8) item self-developed interview guide for the study was given to my supervisor for comments, suggestions, and any corrections. Also, to check for reliability of the instrument to be used for data collection, it was pre-tested on teachers of two Junior High Schools (Dr. H.S. Bannerman Basic School and Knowledgeworth Premier School) within the study area. Feedback from the pilot study was used to finetune for clarity and ambiguity of the interview guide.

3.8 Data Collection Procedure

These are the processes and means by which information was collected on the area of study from participants, in order to help answer the stated research questions and analyse the data collected. Prior to my data collection, I first sought permission from the Metropolitan Directorate of Ghana Education Service (GES) in Accra, with an introductory letter from the Department of Teacher Education (Appendix A), College of Education, University of Ghana, Legon to facilitate the process.

Then with the approval and introductory letter from the Education Directorate to the Circuit Supervisors in the Ablekuma South District (Appendix B), I sought further permission from the school heads to carry out the interviews and observation with selected teachers to whom I

explained the purpose of the study. They were assured that the study was only for academic purposes and assured of confidentiality and anonymity. Pre-arranged dates for the interviews and observations were also scheduled. Then with a semi-structured interview guide, I interviewed the teachers face-to-face individually which I recorded using a voice recorder for later transcription and analysis.

Another day or the same day where possible I went to observe the teaching of participating teachers in their classes. I sat through their lessons from beginning to end and took notes of the process of teaching. This was to enable me to check against possible teaching strategies which I anticipate would be used by teachers in their classrooms. Observing participants helped me ascertain what teaching strategies they actually use and check for appropriateness.

3.9 Data Analysis

This is the process by which collected data is analysed and explained to come up with answers to the research questions. The data obtained through the interview and observation was transcribed first and analysed with the help of NVivo 8. After all the required qualitative data were obtained, it was subjected to a thorough thematic content analysis.

Coding Strategies

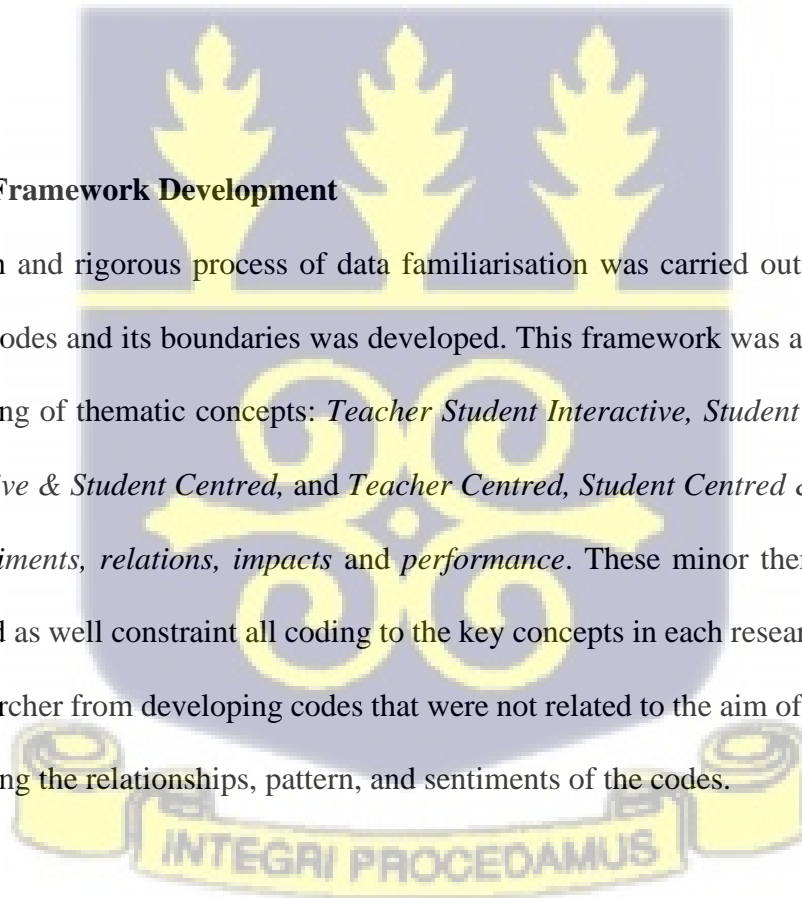
The coding was done in four phases. These were familiarisation with the data, code framework development, code searching, and classification of codes into themes.

Phase 1: Data Content Familiarisation

The researcher manually and thoroughly scrutinised (reviewed) all the transcribed data (responses) to get abreast with the content of the data and identify the commonness, differences, diversities, sentiments, relationships, and patterns in the responses of the participants. This enabled the researcher to identify the background characteristics of the participants and discover the various characteristics (concepts) that provide meanings to each research questions being addressed. It also enabled the researcher to know what constitutes the codes, how to develop (create) and structure the coding framework and codes in the NVivo. After that, the researcher then manually collated all the background profile of the participants and other information into excel sheet and performed the analysis.

Phase 2: Code Framework Development

After a thorough and rigorous process of data familiarisation was carried out, a framework for developing the codes and its boundaries was developed. This framework was a coding guide that set out the guiding of thematic concepts: *Teacher Student Interactive*, *Student Centred*, *Teacher Student Interactive & Student Centred*, and *Teacher Centred, Student Centred & Teacher Student Interactive*, *sentiments*, *relations*, *impacts* and *performance*. These minor themes served as the boundary for and as well constraint all coding to the key concepts in each research objective. This limited the researcher from developing codes that were not related to the aim of the study. Also, it guided in outlining the relationships, pattern, and sentiments of the codes.



Phase 3: Code Searching and Revision

After developing code framework, the researcher inputted all the transcribed data into NVivo as interview files in a single folder called interview folder. Then in the code section of the NVivo, the researcher created code classification (i.e., *Teacher Student Interactive*, *Student Centred*, *Teacher Student Interactive & Student Centred*, and *Teacher Centred, Student Centred & Teacher Student Interactive*, *grouping*, *demonstration*, *project*, *discovery*, *sentiments*, *relations*, *impact*, *performance etc.*) to assign codes (i.e., phrases, words, or concepts) to each. These classified codes were considered thematic concepts.

In the NVivo, the interview files were opened and for each file, the expressed phrases, words, and concepts that demonstrate each of these classified codes were selected and copied into each that deemed appropriate. Also, statements or sentences within which these codes were identified were also selected as sample quotes for each thematic concept.

The codes were then revised severally to ensure it was done appropriately and each code was assigned to the right thematic concept.

Phase 4: Classification of Codes into Themes (Themes Development)

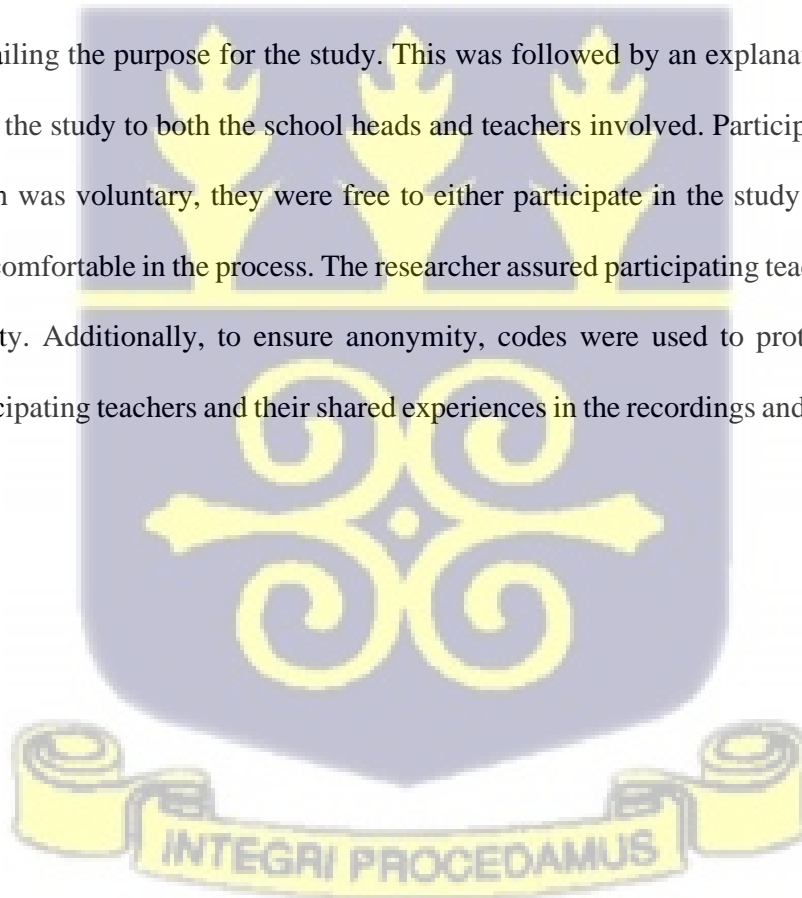
It is in this stage that all the classified codes identified were categorized (compiled) into minor and major themes based on the main concepts in each research objective. The minor themes, which were *teaching methods*, *teaching approaches*, *impacts* and *academic performance*, *sentiments*, *relationship*, *difference*, and *pattern*) were then regrouped into major themes (i.e., *teaching methods and approaches*, *appropriate teaching methods and approaches*, *impacts of teaching methods and approaches on academic performance*, *challenges*) based on the key concepts in each research objective of the study. This categorization was done to provide meaningful responses to

each research question. It also involved discovering patterns, relations, and differences in the themes.

Concerning the objectives of the study, the minor and major themes were then assigned to each appropriate research objective.

3.10 Ethical Considerations

Permission was first sought from the Metropolitan Director of Education and with an introductory letter and approval granted, circuit supervisors and school heads were shown copies, plus a personal letter from the researcher to the school heads of the schools where participating teachers were sampled for the study detailing the purpose for the study. This was followed by an explanation of the purpose and objectives of the study to both the school heads and teachers involved. Participants were told that their participation was voluntary, they were free to either participate in the study or to withdraw if they did not feel comfortable in the process. The researcher assured participating teachers of anonymity and confidentiality. Additionally, to ensure anonymity, codes were used to protect the identity of schools and participating teachers and their shared experiences in the recordings and observation notes.



CHAPTER FOUR

DATA ANALYSIS AND DISCUSSIONS

4.1 Introduction

This chapter looks at the analysis and interpretation of the results of the data that was collected for this study and analysed it in relation to the objectives. The first part of the study looked at the demographics of the participants. Also, the results for the study were presented in accordance with the objectives of the study. This is followed by results of findings and discussions of the findings of the study.

4.2 Findings

4.2.1 Demographic Characteristics of Participants

Table 3 : Representation of participants per subject area

Subject Area	Male Participants	Female Participants	Total
Mathematics	9	1	10
Integrated Science	9	1	10
TOTAL	18	2	20

The study covered ten (10) Junior High Schools made up of five (5) public and five (5) private schools and included both male and female teachers of the subjects. This was done to ensure even representation of Junior High Schools as well as gender participation in the study area. Overall, twenty (20) teachers comprising ten (10) Mathematics and ten (10) Integrated Science teachers

were interviewed. Of the number, there were nine (9) male teachers each for both Mathematics and Integrated Science and one (1) female each for both subjects. Thus, the study recorded eighteen (18) and two (2) male and female teachers respectively for the study. The study had more male participants in comparison with female participants which is representative of both gender who teach both subjects in the study area. The study also captures the number of years participants had taught in the subject areas (Mathematics and Integrated Science), the level they taught and their educational backgrounds or qualifications.



4.2.2 Demographic Characteristics of Participants in Mathematics

Table 4: Participants’ Demographic Characteristics (Mathematics)

Characteristics	Category	Count
Gender	Male	9
	Female	1
Education Qualification Level	Teachers’ Cert ‘A’	1
	Diploma in Education	2
	Bachelor in Education	1
	Other Qualifications (HND, Bachelors, Masters)	6
Continuing Education	Yes	4
	No	6
Professional Status	Professional Teacher (Education Background)	4
	Non-Professional Teacher (No Education Background)	6
Years of Teaching	Mathematics	10
	1	1
	2	1
	3	0
	5	1
	10	1
	11	1
	21	2
	22	1
	23	1
Class Taught	Form 1, 2, and 3	5
	Form 1 and 2	1
	Form 2 and 3	3
	Form 3	1
Experiences	Nice, good, exciting	8
	okay	2

Source: Researcher’s Own Construct

Three of the mathematics teachers had taught for between one (1) and five (5) years. Another three (3) had taught the subject for between ten (10) and eleven (11) years, with the remaining four (4) having taught the subject for between 21 and 23 years.

Five (5) of the participants were found to teach all three JHS levels, with four (4) of them teaching two levels such as JHS 2 and 3 (3 teachers) and JHS 1 and 2 (1 teacher) with only one of them teaching JHS 3. Out of the number of participants, four (4) mathematics teachers were professionally trained teachers before their teaching career with certificates ranging from teachers ‘Cert A’ (1), Diploma in Education (2) and one teacher with a Bachelor’s in Education.

The other six (6) participants were trained in other professions before teaching without prior training in education but have pursued or still pursuing courses to the Masters level in Education and Educational Leadership.



4.2.3 Demographic Characteristics of Participants in Integrated Science

Table 5: Participants’ Demographic Characteristics (Integrated Science)

Characteristics	Category	Count
Gender	Male	9
	Female	1
Education Qualification Level	Teachers’ Cert ‘A’	2
	Diploma in Education	2
	Bachelor in Education	3
	Other Education (HND, Bachelors, Masters)	3
Continuing Education	Yes	-
	No	-
Professional Status	Professional Teacher (Education Background)	7
	Non-Professional Teacher (No Education Background)	3
	Integrated Science	10
Years of Teaching	3	1
	5	1
	8	1
	5	1
	8	1
	9	1
	10	2
	12	1
21	1	
Class Taught	Form 1, 2, and 3	7
	Form 1 and 2	-
	Form 2 and 3	3
	Form 3	-
Experiences	Nice, good, like it	6
	Challenging, Not been easy, difficult	4

Source: Researcher’s Own Construct

For Integrated Science participants, two (2) of the teachers had taught the subject for three (3) and five (5) years. Another five had taught the subject between 8 and 10 years with the other three participants having taught the subject for between 12 and 21 years. Seven (7) of the participants

had been trained as teachers prior to their teaching career with the other three (3) training in other Bachelors programmes (Engineering, Biological Sciences and Finance).

Of the trained teachers, two had teachers 'Cert A' qualification at the training college, two with Diploma in Education and the other three with Bachelor's in Education qualifications.

Of the participating teachers, seven out of the ten taught all three JHS levels, while the remaining three taught only two levels at the JHS. Only one Integrated Science teacher was female just like her counterparts who teach Mathematics.

The demographic data captured above are indicative of the fact that the participants selected for this study are a representation of the population of schools and teachers sampled for the study and shows that the teachers have long years of experience teaching the subject.

After reading the interview transcriptions and listening to the recordings over and over again, the key themes emerging from the interview data collected from participants were:

- Teaching strategy preferences of JHS Mathematics teachers
- Teaching strategy preferences of JHS Integrated Science teachers
- Teachers' views on supposed appropriate teaching methods or strategies to be used in teaching Mathematics and Integrated Science in JHS and their impact on student performance

Other sub themes that emerged were also from the data collected

- Reasons and results of teachers' use of preferred strategies and methods
- challenges and limitations to teachers' use of appropriate teaching strategies and methods in teaching Mathematics and Integrated Science.

Analysis of the data was done in relation to the emerging themes and sub-themes from the data collected through semi-structured interviews from participants were interpreted using narratives, participant quotations and summaries to ensure that the topic under study is clearly understood.

4.3 Research Question 1

4.3.1 What teaching strategies do Mathematics teachers use in teaching JHS students in Accra?

In order to elicit answers to the first research question relating to the teaching approaches and methods that Mathematics and Integrated Science teachers use in teaching their Junior High School students the participants were asked one direct question (question 3). This question sought to find out the actual strategies or approaches they use to teach the subject.

In response to the question, participant Mathematics teachers responses were given as follow as shown below:

Mathematics Teacher one: *“I always prefer the child centred approach, okay, mostly in mathematics we, at the basic level we guide them and probably you lead and they continue themselves, so when I use that approach, it makes all of them involved in the lesson.”*

Mathematics teacher two: *“I use interactive methods this time, but I use what they call scaffolding, Vygotsky’s so I guide them, so that they build up on what they know.”*

Mathematics teacher three: *“Nowadays we are not using teacher centred because, you want them to also develop their talents, so now it is student centred, every majority, 70% of the work is from*

them, you only put the key points there and direct them, help them, go round, supervise them so that you develop their talents, so no more teacher centred.”

Mathematics teacher four: *“I often use the child centred. Child centred is what I use because, as I said mathematics should be practical so if you allow the children to be part of it then they will understand it faster or easier than if you are talking or demonstrating to them alone. They should be part of what you are doing, even let them, you should let them do more examples, they should do more work than even you the teacher and when talking too, the talking should be less but the practical aspect of it should be more.”*

Mathematics teacher five : *“ I use teacher pupil interaction, so that is where I introduce the lesson guide them to get the concept for the day, the objective for the day, the objective to be achieved for the day and then I also get a response from them through questioning. So, I put questions to them, just to elicit their views on what has been learnt, so they also ask questions on areas they have some challenges so that as a teacher I could make corrections or redress if something is not going on well so we are able to measure our weaknesses and strengths.”*

Mathematics teacher six: *“ I can say it’s both, it is teacher student and student teacher, because when, they are kids, the more you engage them and interact with them, the more they get interested and focused in the subject that you’re teaching.”*

Mathematics teacher seven: *“It is a teacher student interactive one. Because, it is not based on me alone I and the students, anything I and the students interact.”*

Mathematics teacher eight: *“I will say it involves, I, student centred because, I allow them to have that freedom to do their discussion, so when they are done then, I finally summarise whatever has been discussed withing the groups, then, I build on their knowledge to summarise whatever has been discussed in the group. So, I will say it is learner centred mostly. At times we have teacher centred too in a situation when you have to lecture for them to get the understanding, so it’s mixed, we normally use it jointly.*

Mathematics teacher nine: *“Okay, most times child centred and some other times, interactive, teacher and learner interactiveness, but, for a situation where it will be teacher centred I’m not sure you will be able to, well I can’t tell, but to achieve your aim might be a bit difficult if you are the only master in the class and you are saying what you want to say, I’m not that sure it will achieve your aim.*

Mathematics teacher Ten: *“Mine will be teacher student interactive methods because sometimes most of them we only do it when classes, some of them have knowledge for it so before I even start, I ask who has idea on this topic so that maybe if I don’t know the method, sometimes I do learn from the kids, if I don’t know the methods I think if the child brings his or her idea, I just add up to mine.”*

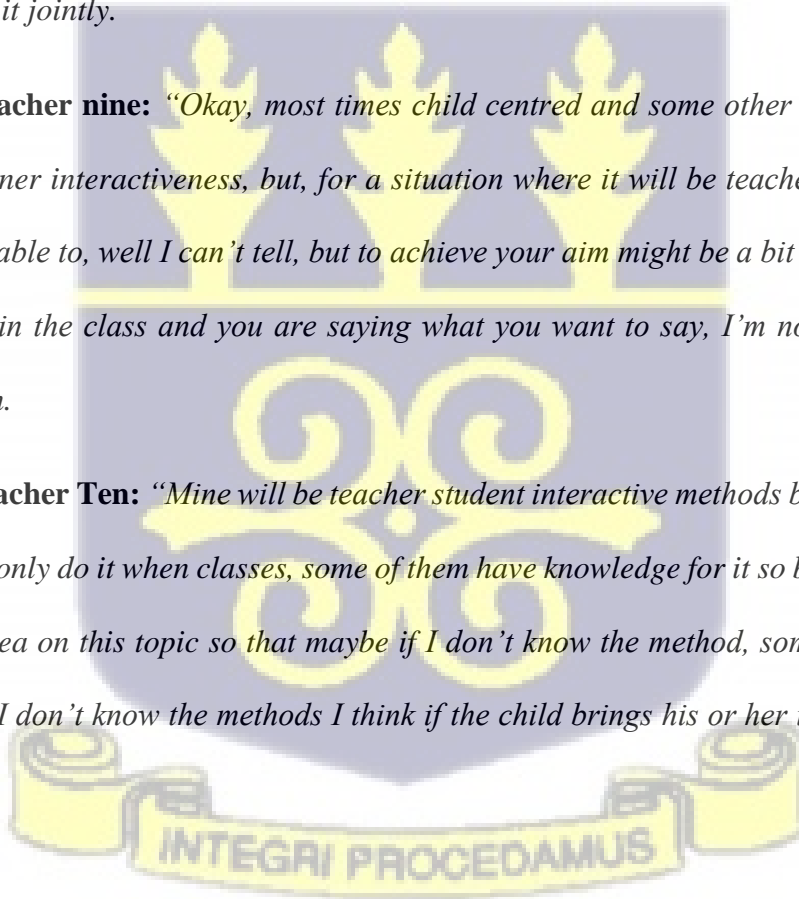


Table 6: Mathematics Teachers’ Use of Teaching Strategies

TEACHING STRATEGY	NO OF PARTICIPANTS
Teacher Student Interactive only	5
Student Centred only	3
Teacher Student Interactive and Student Centred	1
Student Centred and Teacher Centred	1

Table 6 captures the teaching strategies used by Mathematics teachers and indicates that Teacher Student Interactive approaches are the most popular with Mathematics teachers with five (5) participants’ responses to the question of the teaching approaches that they use in teaching their subject. One (1) of the participants in the study area use a combination of Teacher Student Interactive and Student Centred strategies or approaches, while another three (3) use Student centred approaches only. One other teacher also uses Student or learner centred and teacher centred approaches jointly. These results show that teachers want to have more interactions with students to know what students already know and build on their previous knowledge as well aid understanding of concepts taught.

4.4 Research Question 2

4.4.1 What teaching methods do Mathematics teachers use in teaching JHS students in Accra?

This question was asked to ascertain the actual teaching methods participant mathematics teachers use in teaching their students. The transcribed responses are stated below as follow:

Mathematics Teacher one : *“I use the grouping method, I put them into their various groups in every group they have a leader that is probably better than the rest members of the group and it helps all of them.”*

Mathematics Teacher two : *“I normally engage the children, engage them, we discuss”*

Mathematics Teacher three : *“Role play and grouping to encourage collaboration. You know the thinking capacity is not the same, so any group I form I should get a leader, I make sure the leader explains the things well to the kids, so that everybody will understand. I use what they call scaffolding, Vygotsky’s so I guide them, so that they build up.”*

Mathematics Teacher four : *“Sometimes I use the grouping, I divide them into groups, then I select those above average, I make them the leaders and then I assign those below average to those above average to help them. You see, sometimes when you, their peers teach them, they do understand better than the teacher teaching them. The other one is dramatising, that is where you the teacher try to dramatise what you want to, you want them to understand, so these are some of the methods that I use in teaching them, for them to get it. The other thing is to brainstorm, put the work on the board, allow them to think about it, struggle over it and then when you realise that they are not getting it after going round, those who are not getting it and then I help them, then at the end we solve it on the board for all of them to get it. I do this to help them understand it better.”*

Mathematics Teacher five : *“Normally, some teachers do group students like four in a group, I do pair, the reason is if they are more than two, some of them may disturb each other, but if they*

are two, pair, pair, pair, pair, you can also monitor them, you go round and see whatever they are doing. So, I use pair method. Group learning, helps a lot, it is good so that the good ones will help the weak ones.”

Mathematics Teacher six : *“I use demonstration, with the demonstration on the concept or for a particular objective to be achieved. For example, you are presenting, you are teaching a topic on, just any topic, let’s say for example mapping, so as the facilitator, you demonstrate how mapping is done, either you use the teaching and learning material as in TLM prepared, or maybe use the board, you demonstrate it, then you now call on pupils to also do so. We also have the grouping, we believe for a lesson or learning to be child centred you also put them into grouping so that there will be peer teaching.”*

Mathematics Teacher seven : *“It depends on the particular topic you are teaching and the class. I do demonstrate, for instance when I am teaching sets, I do use some items like counters, different types of counters and then I do let them know that, this is a set of an object being a particular set of counters. So, at the end of the day, they understand what you are doing. I do group them and then give them project works, for instance, they have about three groups so whenever you are giving them project works you can give different project work to each and every group so when you bring it out then you explain it to them and then they get the understanding very well.”*

Mathematics Teacher eight : *“Demonstration. When I am teaching, I assume I am also one of them so I say we are learning, we are going to learn, we are learning, so I make them aware that I am also part of them, so anything I am doing I do with them, I do it for the whole class to know.”*

Mathematics Teacher nine : *“I allow them to have that freedom to do their discussion, so when they are done then, I finally summarise whatever has been discussed withing the groups, then, I build on their knowledge to summarise whatever has been discussed in the group. At times you have to lecture for them to get the understanding, so it’s mixed, we normally use it jointly.”*

Mathematics Teacher Ten : *“I normally employ the grouping and it could be that you have a kid who is very knowledgeable in a particular concept so when the group is formed, so that kid transfers his knowledge to the other ones. Most of the strategy I use has been group discussion, group activity that is what I normally use, but I at times use group method though but I think I mostly employ group activities. I think the children are learning better from their colleagues and they tend to feel free when they are with their colleagues.”*

From their responses, grouping tops the preferred choice of methods with nine (9) teachers using the teaching method.

Demonstration follows the list with five (5) of teachers using the method to teach the subject, followed by two teachers who use Role play. Other methods are project work, scaffolding and brainstorming as shared by the teachers. This further shows that Mathematics teachers know and use a variety of methods to engage students in the teaching and learning process. Their choice of strategies and methods are mostly interactive and student centred approaches to aid interaction with the students to introduce lessons, know the level of students’ knowledge on concepts to be taught . The choice of methods also shows that teachers use methods that allow students to interact with each other so they can work collaboratively with each other and learn from each to aid better understanding of concepts by students.

4.5 Research Question 3

4.5.1 What teaching strategies do Integrated Science teachers use in teaching JHS students in Accra?

Like their Mathematics counterparts, Integrated Science participants' responded to the research question of the strategies they use in teaching their students as follow:

Science Teacher One: *"Yes, teacher student interactive."*

Science Teacher Two : *"It is Teacher student interactive. I don't, if I put a topic on the board, not to say I am a teacher so I know all I just start and explain, so I ask of their views first, what do you know about this, can you explain this, as if I don't know anything so by gathering those information then I know where to hit, that the student knows this, they know that so as we interact, I do interaction with them, before the end of the day they've all understood what I am trying to say."*

Science Teacher Three : *"Infact, Teacher Student Interactive methods."*

Science Teacher Four : *"I use all the three, when it comes to the teacher centred one, that one I do more of the talking, though I don't use it often, because I use it depending on the topic I am teaching, for example when I am doing elements, I don't get more of the physical things to show that this is potassium or, so that one I must just use the diagrams and explain more. There are some topics I do teacher and child interaction, that one I just ask them questions and they will explain, but I have realised that my pupils, my students don't often like to explain on their own so now I encourage them to, you say what you have, and I will just polish it up for them, but I love*

that one more than me explaining, I love it and sometimes when they bring their views you can see that they have some sensible ideas. In the student centred, in that one, I normally allow them to do their own thing, sometimes I even group them and I pick leaders, those who are brilliant and I ask them to read and explain, where there is difficulty then I come in, sometimes I do that.”

Science Teacher Five : *“The teacher student interactive one.”*

Science Teacher Six: *“They are student teacher interactive methods. I say so because at the end of the day I am not the one going to do the spoon feeding, because I give them research work, project work, group work and then they sit and then they discuss they bring up their ideas so in class we discuss. So, at the end of the day someone who is weak in the class will also have something to say, will understand something....”*

Science Teacher Seven: *“teacher student interactive. It’s only the lecture method that, and that one it’s not many, but the discussion it’s teacher student, the practical that one is mostly the students because you let them experiment because you’ve put them into groups you observe what they are doing they tell you what they’re seeing why should this be...then you also, so I vary the styles.”*

Science Teacher Eight : *“Student centred. The whole thing is, it’s like a process, teaching and learning, on the part of the teacher he or she would teach, and on the part of the student they are to learn so the end of the whole process is the learning on the part of the student so if whatever thing you are disseminating is not getting to the student or is not getting to their understanding*

it's like the gap, that's that process is being broken, so I think everything that will be done in terms of teaching should centre on the student."

Science Teacher Nine : *"I use the Teacher Centred and Student Centred. Sometimes the lecture comes in but, I will, majority is I will say student centred, majority. I engage more students, I ask probing questions so most at times even if I am teaching and I ask the question 'do you understand,' they never want to raise their hand because I am not the type after I have asked you the question and you stand up and say, okay for instance, I have asked a question then you give an answer I will allow you to sit down, you must explain to me why you have given that as an answer."*

Science Teacher Ten : *"I normally use the student centred and then the teacher student interaction, that's what I use. The reason why I do that is I want to engage the students as well as I teach, when the whole thing is teacher centred the class becomes boring, but when you engage them they also feel like they are part of the whole thing..."*

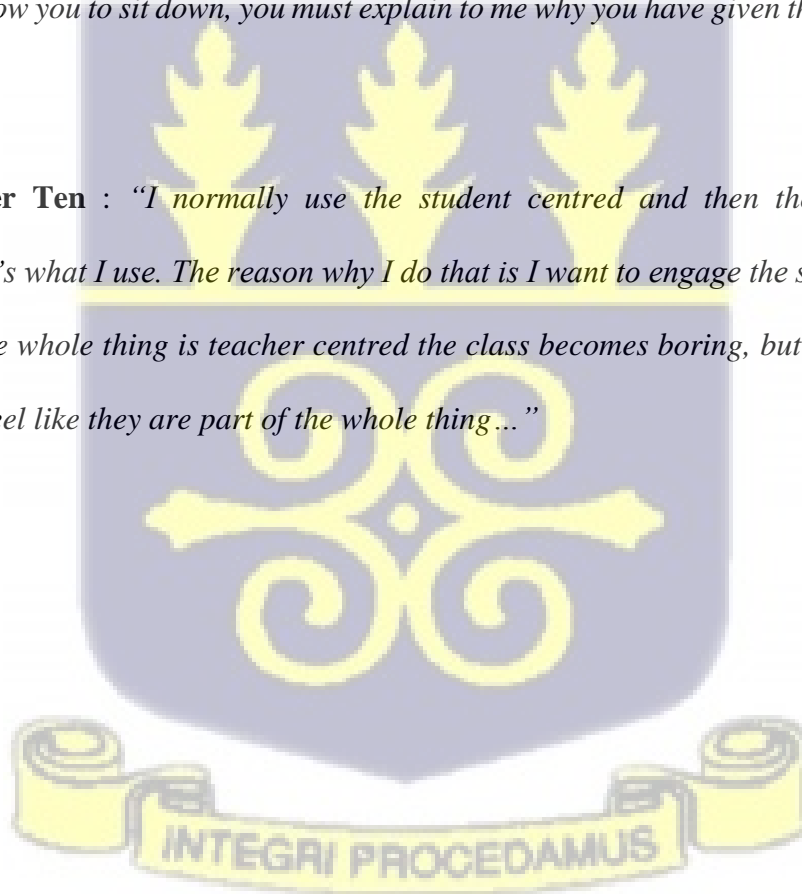
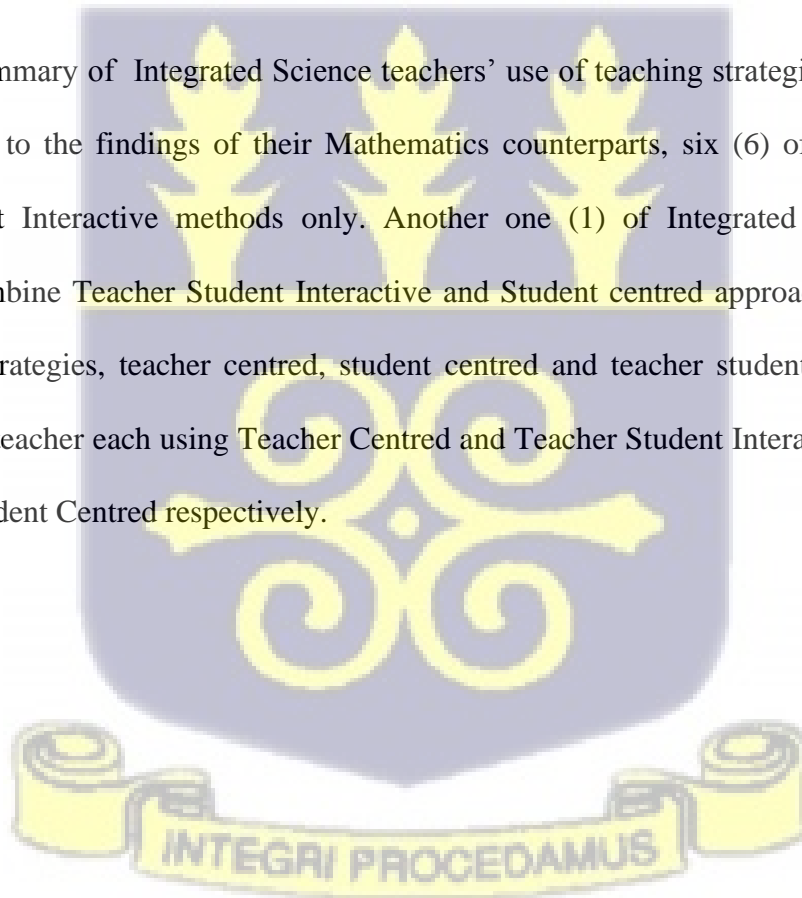


Table 7: Integrated Science teachers use of teaching strategies

TEACHING STRATEGY	NO OF PARTICIPANTS
Teacher Student Interactive only	6
Teacher Student Interactive and Student Centred	1
Teacher Centred and Student Centred	1
Student Centred Only	1
Teacher Centred, Student Centred and Teacher Student Interactive	1

Table 7 is a summary of Integrated Science teachers' use of teaching strategies in teaching the subject. Similar to the findings of their Mathematics counterparts, six (6) of the teachers use Teacher Student Interactive methods only. Another one (1) of Integrated Science teachers preferred to combine Teacher Student Interactive and Student centred approaches. One teacher uses all three strategies, teacher centred, student centred and teacher student interactive, with another one (1) teacher each using Teacher Centred and Teacher Student Interactive and Teacher Centred and Student Centred respectively.



4.6 Research Question 3

4.6.1 What teaching methods do Integrated Science teachers use in teaching JHS students in Accra?

Science Teacher one : *“At times I use discussion method, between myself and the students, or I put them in groups for them to discuss depending on the topic we are treating or the subject matter. The discussion is either between me and the students and the students among themselves in groups. students mostly learn from their peers better than learning maybe from the teacher, so I allow them to communicate among themselves and there are some things that they may say in the local language maybe if they are talking to the teacher, they cannot say those things but their friends will be able to explain better to them, that’s why I allow them at times to. Then, we also use the practical method. So, in science there are a lot of practicals so you give them an activity to perform, yes, so let’s say ‘separation of mixtures’ so you give them let’s say sand and iron filings mixed together and you ask them to separate using a particular method of separation, then you guide them to do the practicals and they understand it very well.”*

Science Teacher Two : *“I normally use TLMs, we also at times we go out when we are looking at let’s say, photosynthesis like this, you don’t have to be in the class we need to pluck some trees (leaves), especially with the experiment so I love doing much more of the experiment, because the theory, those who are slow learners will not grab it. It is said that children learn more from what they see and action that they are involved in than, so I do that and I am able to get everybody involved to understand, so at the end of the day I am able to achieve my goal.”*

Science Teacher Three : *“Let me say, let me consider the science for instance, science is not about I mean showing the, I mean what you are telling, they should see it practically, so you try as much as possible to get them the available materials which you know that, infact this, it will be very helpful, you show them, then you try to explain to them how they should be used or how or how, infact how they are used (demonstration) so that they will get the concept. So infact for them, it is more of practical than theoretical. You show them the practical aspect then you talk about the theory for them to know what is it, based on when they go for exam and they are asked, ‘what do you understand by?’ they will be able to explain, apply.”*

Science Teacher Four : *“Apart from brainstorming, we have a lot of practicals here, we normally do it in groups, recently we had an experiment on evaporation, a subtopic under mixtures, so we were trying to understand that you can separate solute from solvent when the solute is for example, salt and the solvent is water.”*

Science Teacher Five : *“Grouping, Role play, because science has to do with things around us so there are times when you have to allow them to role play the topics that you are about to teach and from that role play you begin to ask them questions, so I use a lot of role play.”*

Science Teacher Six : *“I use the pictorial representation or diagrams to teach since we don’t have the apparatus here in Ghana, we use the diagram, sometimes I use the video for them and then sometimes, practicals, or I give them project works to go and do at home and then group work these are the methods I use for them. At the end of the day, I get most of the weaker ones co-operating in the lesson.”*

Science Teacher Seven : *“I use discussion, practicals and sometimes lecture, it depends on the topic. Because that is what makes them understand it better, because the practicals depending on the topic anyway it’s not every topic, we don’t have a lab here so, with most of the topics you can improvise so once you improvise the children will have a feel of it and see what is happening. Sometimes you need to lecture because, it’s like it is in the abstract form, something like the basic elements like the first twenty elements that one hydrogen me myself I have not seen it before I was taught so I have to, so some of the topics come in the lecture form, and then the discussion, when you’re teaching something like reproduction, it’s like they know something already, so you let them bring their views then you also build on it then you let them have more knowledge about it, so me, because of the subject I teach I employ these skills in my teaching.”*

Science Teacher Eight: *“I don’t have one, the reason being that every particular topic has its own things that it comes with and that may differ from another topic, so topic by topic there are some that you have to demonstrate, that one is very, very key, there are times too that you do the lecturing and asking of questions, with couple of them that you blend depending on the subject, that’s the topic, depending on the topic that you are treating. I do the grouping ones too, I do that of the project type where you’ll be giving them project work, group them, giving them group discussion.”*

Science Teacher Nine: *“Apart from grouping then, lecture method, then activity, where for instance, I just moved from the form three class, we demonstrated the various methods used in making a magnet, so after my demonstration, if you just demonstrate and you leave them, so I call individuals to also come and involve themselves in the demonstration so that at least, I don’t expect them to sort of memorise, so that when it comes to the examination room based on what you did*

you can write in your own words, I believe in that a lot but, in writing in your own words there are some key terms so, I only make sure those key terms are made known to the child so that in using your words those key terms needs to come, example for instance when you are defining something. Demonstration is carried out for them to know how that thing is carried out as in demonstrating this before the class not only me demonstrating, that's why I keep samples so that it goes round, I will call individuals when the person is not doing it right we go over so that the learning will actually be relational not rote."

Science Teacher Ten: *"I group the students, you group them and give them a particular task for them to go and solve, when they work in groups too it helps them to learn together of course with the groups it is compulsory, like it is a compulsory thing that you have to do."*

The responses of Integrated Science teachers in Accra show that they also use varied methods to teach their students in JHS. Integrated Science teachers use mostly Student Centred and Teacher Student Interactive methods like grouping, demonstration, discussion, project, activity, and roleplay with discovery, outdoor and Lecture methods minimally used. Grouping tops the most used method with six (6) of teachers sampled using the method, followed by project/activity with five (5) teachers, demonstration with three (3), followed by Lecture with two (2). Outdoor, roleplay, discovery and discussion were used by only one (1) teacher each. However, the low usage of methods like outdoor, roleplay and discovery and inquiry for teaching Integrated Science for instance takes a toll on how well students understand concepts taught and subsequently how well they perform academically. This is because using these methods help students practicalise what is being taught (Ameyaw-Baah et al., 2018). The low usage of Inquiry method goes contrary

to what Riordan et al., suggest that inquiry methods develops the research skills of students and helps them learn or gather new information through experiments and observations which helps them construct their own meaning.

From the responses elicited from participants, it can be seen that with both Mathematics and Integrated Science teachers constructivist teaching approaches are preferred to enable them promote teacher-student and student-student interaction. This is reflected in the strategies and variety of teaching methods that are carefully selected and used in teaching their subjects and various levels of students. Teacher centred strategies and methods like Lecture are minimally used by teachers of both subjects and this can be attributed to the fact that teachers believe in the use of interactive methods to help engage and involve students in lessons, so that they are able to construct their own meaning and understanding of concepts taught and are able to apply this knowledge.

4.7 Research Question 5

4.7.1 What are the supposed appropriate teaching strategies and methods that are used by teachers to teach Mathematics?

This question sought to find out participants' knowledge of any supposed appropriate approaches and teaching methods that are to be used to teach Mathematics and Integrated Science in JHS. Question 6 asked participants to share their knowledge on these supposed appropriate approaches and to mention some of them. This question is relevant because from the literature it is important that teachers apply varied and the right teaching methods and strategies in teaching to bring about the needed changes in students. This is because using inappropriate methods and strategies in

teaching does not promote understanding and ultimately contributes to poor performance of students (Adunola, 2011). Also, Academic performance of students is dependent on the effectiveness of teaching strategies and methods used by teachers (Kimani et al.,2013), as well as bringing about changes in students in the form of learning which translates to good academic achievement (Tebabal & Kahssay, 2013).

Participants' views on this question seemed divided. A few believed that there were supposed appropriate methods to be used in teaching the subjects, others thought that there were no such methods that they know of because the methods used to teach the subjects at any point in time were dependent on what concept or topic was being taught, the level and individual differences of the students. Some teachers in the subject areas in question believed that the subjects are practical and must be treated as such, that is to be taught in a practical and activity-based manner. The actual views elicited from participants on this question are shared below for Mathematics and Integrated Science.

4.7.1.1 Mathematics teachers' (MT) views on the supposed appropriate teaching strategies and methods that are used for teaching Mathematics in JHS

MT1 opined when asked the above question that *"I think those that we have been mentioning so far, the child centred, the grouping. To me that's the best way to go, that's what I think, they are the best to make teaching and learning easier."*(9:51.63-9:58.78)

MT2 adds that teaching the subject must emphasise the practical aspects so that the students are engaged and involved through problem solving. The challenge here is that students want to be spoon-fed and so going this way seems like they are being overstretched. MT3 also thinks that concepts have to be practicalised from the theory and shares that for instance, concepts may be in

numbers but they must be taught to convert their knowledge of numbers into word problems which students find difficult and calls for the teacher explaining it in the simplest way to make students understand and giving them exercises to test their understanding on these problems. MT4's view on the question is that, *"the topic will determine what method or approach you use, so there is no specific, apart from that we are saying the child should be the core point here, child centred and then all the rest you can't use one method, there's no specific method you use this one for mathematics."*(12:57.20-13:14.44) So, in teacher 4's opinion though the child or student centred is preferred the concept or topic being taught determines what method to use.

MT5 shares the view of MT 4 saying, *"the method or the approach that you will use depends on the topic that you are teaching or discussing with them. But, I believe the main method is you involve the children and do more work. So, you have to give more assignments, like homework, you give them more, the more they practice the more they understand it."* (15:11.92-15:45.61)

From the above it seems teacher 5 also believes in practice or problem solving as an appropriate way to teach the subject. On the same question, MT6 submits that because mathematics as a subject has different sides the methods used in teaching must be varied and must also consider the individual differences of students, to quote teacher 6, *"my suggestion is that, there shouldn't be any particular or specific method that should be used throughout. Lecture method for example, seems to be the most appropriate method you could use throughout because it's a matter of standing and presenting, but as I said earlier, I can't settle on one particular method to be the overall or the best method."*(20:13.12-20:43.53)

MT7 did not think in conventional terms on the supposed appropriate approaches and methods for teaching the subject, for this teacher he uses motivation and rewards to encourage the students to love the subject so they can learn and understand and perform well in tests and examinations. MT8

also thinks that students must understand what is being taught in practical terms and so there is the need to use a lot of teaching learning materials to boost the teaching and learning of the subject to help students understand. According to MT9 mathematics should be learner centred, but to use a specific method the teacher thinks it should be a mixture because most of these methods have their advantages and disadvantages, so a mixture of it will be appropriate. MT10 also shared his view on this question as cited here *“well, any strategy that is used in approaching mathematics I think that the basic thing that should come in there should be practically practiced, like mathematics is not something that you just go to the class and talk and write on the board and you’re gone, so whichever strategy that you would want to use being it the grouping, being it the interactiveness bringing them out of the class, whatsoever you are using make sure the children are having their hand in whatever you do, I mean that should be the basic thing. I don’t want to be specific on ‘this approach is used in teaching mathematics’ there are a lot of approaches but, in any of the approaches the children should be practicing, they must have their hand in it.”*(13:44.34-14:38.53)

4.8 Research Question 6

4.8.1 What are the supposed appropriate teaching strategies and methods that are used by teachers to teach Integrated Science?

4.8.1.1 Integrated Science teachers’ (ST) views on the appropriate teaching strategies and methods that are used for teaching Integrated Science in JHS

Integrated Science teachers were also asked the same question to ascertain their views on the supposed appropriate teaching strategies that should be used in teaching their subject in Junior

High School. For teacher one (ST1) teachers must be innovative and incorporate the use of media, the teachers view is shared here as follows, *“let’s say using of films, let’s say media, you mount a stage then maybe the pictures will be displayed on the platform, the procedures will just be, they will be moving according to the procedure then they will be following, watching it as a film will also aid, help them to understand.”*(9:57.75-10:31.31)

For ST2 he believes that teacher student interactive approach must be used to promote engagement of students in the teaching and learning process, but however admits that he does not know of any supposed appropriate methods for teaching integrated science.

ST3 is of the view that the appropriate strategy would be more of the practicals and so it is important to engage in more of the practical aspect because when students see things practically it sinks into their brain more. ST4 answering the question said *“with the science what I think is the strategy should be mainly based on practicals, the theory should be about just 20% and about 80% of practicals,”* (11:16.47-11:29.86) while ST5 also shared the same view that *“I think with science it should be practical, science should be a practical subject, because most of the things in science involves practicals, where you don’t have the necessary equipment it’s like you are limiting the children to the theory aspect instead of the practical aspect so reading, reading, reading, reading, they are used to that, so at the end of the day when they see a practical work they don’t know the approach, I combine the theory and the practical but most of the time we do the practicals.”*(10:02.78-10:34.92) The teacher also adds that where the practical aspects cannot be achieved or done, lessons can be supported with the use of videos on such topics to aid understanding and further learning. The teacher shares that he personally downloads relevant videos on topics which cannot be treated practically because of limitations and transfers them onto

pendrives for the students to go and watch on their own and discusses and explains to them in class later.

According to ST6 from his training as a teacher students believe what they see and it gets stuck in their minds thus, using videos as support in addition to what is taught theoretically is also helpful to make students understand and recall when the need arises, apart from providing an interesting way of learning. Teacher 7 (ST7) said teaching science must be activity centred because that will bring about the comprehension, because at the end of the day for every topic taught students are supposed to apply what they have learnt, for instance after taking a lesson in filtration they can apply it in real life situations from the activity carried out in class and also apply in in tests and examinations. ST8 thinks that demonstration is appropriate for teaching science because most of the concepts that are taught in science are abstract and so without demonstration it will be like speaking in vacuum with nothing to show what the teacher is talking about which worsens issues for students who would not understand the teacher. Demonstration coupled with discussion, observation, asking of questions are appropriate for teaching the subject.

ST9 does not know of any particular strategy or method to be employed with the reason that the students are of different levels so employing a particular method or approach all the time, will also be boring. For the teacher at least more than half of the class should be able to answer or should be able to understand what has been taught for a period and that is what really matters. Teacher 10 believes that demonstration is the way to go for teaching Integrated Science. For this teacher a teacher cannot just lecture, rather there is the need to demonstrate to the class so that they know that *“this is it, this is what my teacher is talking about this is it, so when you don’t demonstrate it’s going to be very difficult for the children to understand. And then also you should also involve the children as you teach.”* (17:46.12-18:11.40)

The responses of Integrated Science teachers on the question of supposed appropriate teaching strategies and methods show that the teachers are of the general view that teaching integrated science must be practical and activity based to ensure that students experiment and have practical knowledge of the subject instead of theory. As one of the teachers shared the practical aspect must cover 80 percent of the teaching and learning process.

Also, there was the view that because students are of different capacities the use of a variation of approaches and methods would be appropriate to engage all students so they experience and are engaged enough to understand concepts taught.

Again, some of the teachers use and have suggested the use of media in the teaching of the subject to make it more interesting and understandable for the students especially the aspects where the concepts taught are purely theoretical and abstract in nature for topics such as elements and the solar system.

4.9 Research Question 7

4.9.1. What are the results of teachers' use of these supposed appropriate teaching strategies and methods on the performance of students in Mathematics and Integrated Science in Junior High Schools in Accra?

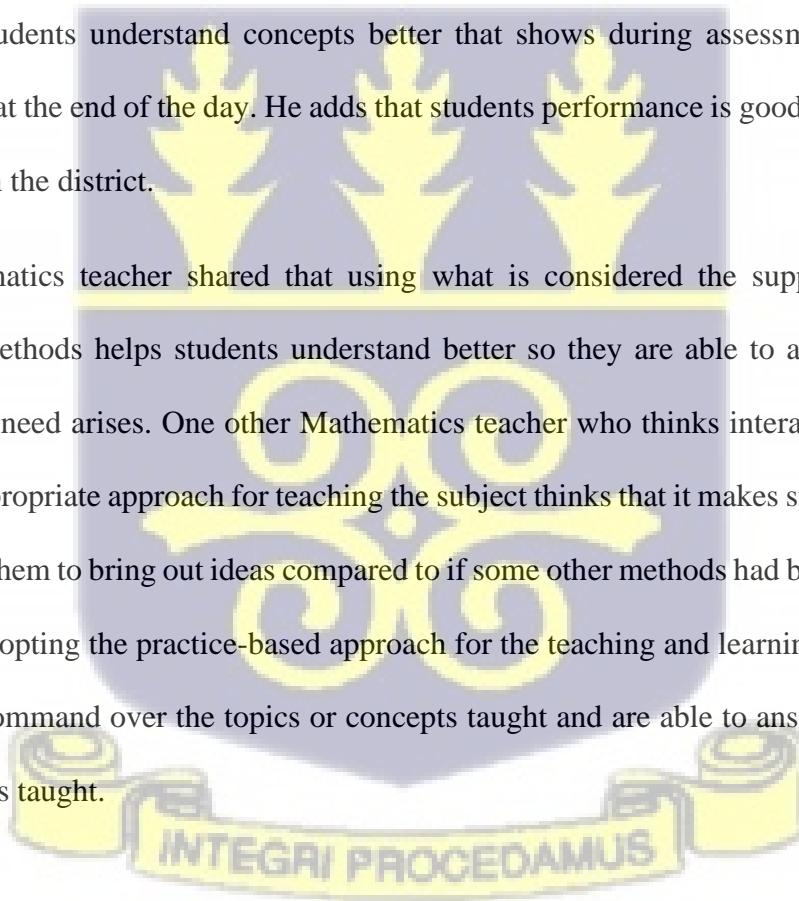
The views of participants were collected in respect to the results of using the supposed appropriate teaching methods that should be used in teaching Mathematics and Integrated Science their responses are shared below for both subjects. Question 8 was asked to elicit the teachers responses to enable the researcher to answer this research question. The question is important because at the

end of the teaching process desirable changes must be seen in learners so as to achieve specific outcomes. (Ayeni, 2011),

4.9.1.1 Results of teachers' use of these teaching supposed appropriate strategies and methods on the performance of students in Mathematics

The responses elicited from Mathematics teachers on the above question are shared as follows. One mathematics teacher (MT1) shared that using the supposed appropriate strategies and methods helps to guide and involve the students in solving problems and this goes a long way to give better results where students understand concepts better that shows during assessment even in their individual work at the end of the day. He adds that students performance is good, though they may not be the best in the district.

Another mathematics teacher shared that using what is considered the supposed appropriate strategies and methods helps students understand better so they are able to apply the concepts taught when the need arises. One other Mathematics teacher who thinks interactive methods are the supposed appropriate approach for teaching the subject thinks that it makes students participate and encourages them to bring out ideas compared to if some other methods had been used. Another view was that adopting the practice-based approach for the teaching and learning of Mathematics gives students command over the topics or concepts taught and are able to answer any questions on these concepts taught.



4.9.1.2 Results of teachers' use of these supposed appropriate teaching strategies and methods on the performance of students in Integrated Science

On the part of the Integrated Science teachers on this research question, most of the teachers believe that using practical and activity-based approaches or methods make the most impact on how students understand and apply this knowledge acquired. One teacher said that the practical and discussion approach help students understand perfectly well to the extent that they are able to share their knowledge with each other. Another teacher added that using the practical methods makes concepts taught sink in for the students.

Another teacher's response was that unlike the theoretical approach which only makes students memorise things, taking the practical approach in teaching science makes students understand because they see and experience things for themselves and are able to construct their own meaning so that when they are asked questions they are able to answer in their own words or with their own understanding of the concepts.

As ST11 puts it, activity centred methods aid comprehension so at the end of the day concepts learnt can be applied academically and to real life situations by students because they actually experimented or practiced the concepts.

One science teacher who believes that demonstration is the appropriate method for teaching science responded that when students see things demonstrated it gives them an idea of what equipment and processes for instance look like and can relate to them so that learning and understanding the subject is not difficult and they can identify with these concepts wherever they may meet them and apply them accordingly when need be.

Adding to the impact of using appropriate teaching methods on performance of students, another teacher who believes demonstration is an appropriate approach shared that because demonstration involves students in the teaching and learning process as well as giving them indepth understanding to the concepts being taught and makes them interested in studying the subject. Once students gain interest and indepth knowledge about the subject they are able to apply these concepts in tests and examinations as well.

4.10 Challenges and limitations faced by Mathematics and Integrated Science Teachers in teaching their JHS students

One other issue emerging from interviews with participants on the phenomenon that was studied was that, as much as Mathematics and Integrated Science teachers desire to use methods that are appropriate and beneficial for teaching and learning of the subjects in terms of achieving positive learning outcomes, they have limitations to using these methods. In most cases, having the right support resources that would enable them utilise these methods prove to be a challenge.

4.10.1 Challenges and limitations faced by Mathematics Teachers (MT) in teaching their JHS students

MT11 said that *“as teachers our challenges are centred on teaching and learning materials. We don’t have enough, should I say enough, do we even have at all, we do not have so at times the little that we have we improvise, we do the minor, minor ones we are able to acquire, but when it*

comes to the audio-visual materials, things that we are supposed to practice, we are found wanting.”(15:26.26-16:09.40)

MT10 adds that *“we do not have majority of the tools and this affects teaching and learning, Maths is mostly practical and you need these tools to aid understanding of what we teach.”(15:26.93-15:59.92)*

The teachers think that considering the subjects in question, there is the need for more activity and practice-based learning because as MT 6 puts it, *“the more the students practice, the more they understand.”*

One teacher added that not having these materials affects performance because, students do not have the opportunity of interacting with these materials, however, *it will be good to interact with these materials on their own but since they are not there we have to do it verbally, but verbally you know that if you are touching the thing you understand better than listening.”*

Some other Mathematics teachers who are in favour of using demonstration method for instance to engage students more and make the subject practical, by means of demonstrating some procedures and use of instruments to students cannot do so effectively because they do not have the resources to help them do so. MT9 opined that, *“we don’t have enough materials and equipment, sometimes when you are doing construction, you need protractors and the rest to demonstrate for the pupil to know, so if there is no equipment like that you the teacher have to buy it yourself, or sometimes you have to use the pupils’ mathematical set, that one too is little, it’s too small so it cannot become broad for them to see.” (10:17.99-10:44.71)*

The teacher further adds that this affects students’ understanding of concepts and their performance in the subject, *“if I the teacher, I am teaching you the subject and I am not having equipment I*

might just read it, it will be like theory, there must be practical for you to know that this one the name is protractor, it's used for this, but when I just say it, if you go to the exams room it's just like theory so you don't get the clear understanding for what the use of that equipment is, so it is very necessary for the teachers to get equipment so that it will help them.”(11:49.70-12:24.08)

Teacher 2 also added that *“we have issues with one of our materials when it comes to graphs, we need a graph board, it's an important part, because when you do that, it makes the teaching easier.” (13:38.78-14:19.30)*

Also, some of the teachers have said that they are limited in the use of technology in teaching Mathematics. One teacher uses videos to teach some concepts but has to resort to the use of a phone which poses some difficulty considering the size of a phone in teaching a whole class.

As MT7 shares, *“we are in a digital age and students are familiar with these digital platforms thus presenting lessons using these digital platforms would enhance the students' understanding of the subject, because you the teacher would get the attention of the students, and you know learning is best when attention is at its best.” (21:25.85-22.10.36)*

The challenge for this teacher and most colleague mathematics teachers is not having projectors to present lessons in this format, the teacher commented that *“we do not have the digital interface to really explore that area.” (22:28.77-22:39.74)*

MT 9 who also supports the use of videos shares this limitation with this comment *“the use of videos too will be helpful, because when they watch it they will see how things are done but buying the data and the phone. Sometimes, they are many so you can't use the phone, you use laptop, that is a little bigger for everyone, and buying the data too, you have to use your own money to buy data.” (14:21.44-14:58.71)*

4.10.2 Challenges and limitations faced by Integrated Science Teachers (ST) in teaching their JHS students

Integrated Science teachers share similar views on their challenges and limitations as follows.

One issue that runs through with participants with the exception of two teachers is the lack of laboratories, equipment, and chemicals to do practical experiments with students. As they have already shared in earlier discussions in this chapter concerning the use of teaching strategies and methods, science must be more of practicals, but, even though they try to make it as practical as possible they are limited. Because of the lack of resources as alluded to earlier, teachers are restricted in the experiments they can do with students. They stick to simple experiments that they can improvise to do with students and so they and the students do not get the full benefits of teaching and learning science. As ST6 captured it which reflects the views of almost all the Science teachers except one or two of them, *“we lack scientific equipment and a well-equipped laboratory.(14:20.39-14:26.10)* The teacher adds that *“if we should get the equipment where each individual will have the equipment performing his or her own thing with the guidance of the teacher, it will be a perfect thing.”(17:51.89-18:01.93)* He thinks that improvisation is not enough. ST5 adds that, *“Because it is normally not being practical they easily forget so you see that you give them class exercise they score nine, they score ten some score eight, the lowest could be five, but when it comes to exams it becomes very difficult for them to recollect because it was not done practical, so it looks as if in class they are doing well, but when it comes to exams then you see them falling, so that is it, and the BECE has also been like that, the BECE, there are some questions you say, you go bring your exercise books let’s see if you have not solved all these questions before and they go and bring it, ‘I say look at it, I say we’ve done it they say, I forgot,’ because it wasn’t practical, theory, theory, theory, theory, so that has been the challenge.” (21:05.54-22:10.78)*

The teacher who finds grouping or collaborative and co-operative learning beneficial to students added that the size of the classroom is small and the furniture students use makes it difficult to put students in groups to do collaborative work in class.

One teacher (ST7) added that *“because we don’t have the lab most of the things sometimes you can’t even improvise, so if there were to be a lab or they even had the movable labs where you can have the science equipment, a small trunk where they have these chemicals and some apparatus and other things, so some basic things like measuring cylinder, beaker, it will be there for you to show to the children, here I bought my own test tube and things, there was nothing here, meanwhile you are to teach for the child to pass. They assess all of us the same so if they could and some of these reagents too for the testing and other things unless you buy them yourself and they are all challenges.” (10:21.24-11:19.41)*

ST12 said that Science must be taught in a practical way, but where there are no labs, chemicals, equipment to make students see what is being taught it makes teaching difficult.

Another teacher (ST8) thinks discovery or outdoor learning would be a good approach to facilitate the teaching of science and would have loved to go on trips and excursions with students so they could interact and learn from the outdoors and discover things by themselves and be able to construct their own meaning but there are constraints and so has not been able to implement these methods.

Added to the above some teachers think that the use of videos in teaching the subject is an innovative approach to explore. As ST8 puts it *“I can get the videos, I have to use my phone but the screen is too small and I have to show it in groups and that is also time consuming.”* ST4 also has the same issue teaching with videos, the videos captures the interest of students, but only a

few of them are able to get the full details of what is shown because of the size of the phone's screen, it has to be repeated several times whereas having a well-equipped Information Communications Technology (ICT) laboratory would make it easier to project.

From the above it can be concluded that teachers have the wish to use appropriate and beneficial methods to teach Mathematics and Integrated Science in the Junior High Schools, and to make teaching the subjects as practical and constructivist as should be, but they have limitations. They have had to make do with what they can manage with, which does not augur well for the teaching of the subjects in relation to the learning outcomes that are expected of them and should be achieved.

4.11 Discussions

4.11.1 Importance of using teaching strategies and their impact on teaching and learning

From the responses gathered in respect to questions 1, 2a and 2b, it was established that teachers have knowledge about teaching strategies and methods in teaching in general and also find them to be an important and beneficial part in the teaching and learning process and the teaching of their subjects. They shared that the strategies and methods when used, facilitates teaching, gives teachers a plan and strategy to transmit knowledge to students to achieve learning outcomes and also help the student understand concepts taught. This is in line with what Ayeni (2011) says about teaching being a systematic process of transmitting knowledge through the application of appropriate strategies to achieve specific learning outcomes (Adunola, 2011). Fajamidagba et al., (2012) share a similar view that they are a sequence of teaching procedures designed to facilitate

the achievement of particular teaching and learning objectives. Thus, the views shared by the teachers support the assertions of these educational experts cited above.

Again, from the responses gathered from participants on questions 3, 4,5 and 6, it is established that participants have knowledge about the different categories of teaching strategies and methods, have reasons for their preference for these particular strategies and methods. They also vary the usage of these methods and strategies considering the topic, level of students and concepts being taught at any particular point in time in the teaching and learning process.

These results support and affirm Adunola's (2011) assertion that teachers need to know and have varied approaches and use them taking into account factors such as the subject being taught, level or degree of concepts that are being taught and in addition apply the appropriate ones to the teaching process.

4.11.2 Research Question One

What teaching strategies do Mathematics teachers use in teaching JHS students in Accra?

Responses from participants show that JHS Mathematics teachers use mostly Teacher Student Interactive, a combination of Teacher Student Interactive and Student Centred, and Student Centred approaches in teaching their subjects. Teacher centred strategies are not used much because such strategies do not engage students actively in the teaching and learning process thus, does not promote understanding of concepts. This supports Di Biase (2019) that using such approaches do not lead to a change in student behaviour, that is to say learning, because the aim or objective of teaching is to promote a change in learners to enable them acquire new knowledge skills and attitudes. Their use of student centred and interactive methods further affirms Li et al.,

(2018) and Day et al., (2016) assertion that using these strategies enhances student achievement better and more holistically than teacher centred ones through active engagement of students.

Their use of these approaches further supports Vintere (2018) that their idea for using these methods to teach Mathematics is to promote better understanding of concepts and good performance through active engagement of students in problem posing and solving, as well as changing the teaching and learning process of the subject from teaching abstract concepts to applying them to real life experiences.

4.11.3 Research Question Two

What teaching methods do Mathematics teachers use in teaching JHS students in Accra?

From the participants' responses, the topmost preferred methods are grouping, demonstration and roleplay. These methods are student centred methods which supports McKnight, O'Malley, Ruzic, Horsley, Franey, and Bassett., (2016) that using student centred methods and approaches are suitable for teaching complex concepts and also develops socialization and good interpersonal skills in students as they work together, share ideas and communicate with each other. Grouping like the teachers shared helps students learn from each other concepts that they previously found difficulty understanding as posited by Capar and Tarim. The teachers' use of demonstration method also aligns with Daluba (2013) that using activity-based student centred approaches like demonstration method helps students perform better, because they experience concepts practically as they are motivated to learn with all their senses and leads to retention. These approaches also enable students find solutions to mathematical problems (Hassan & Ibrahim, 2018). This further supports Riordan et al., (2019) that using these approaches make students actively involved in the

teaching and learning process as they are engaged in activities that require that they explore, research, gather and process relevant information that they interpret and share with their peers.

4.11.4 Research Question Three

What teaching strategies do Integrated Science teachers use in teaching JHS students in Accra?

Integrated Science teachers' high use of Teacher Student Interactive and Student Centred approaches or strategies also falls in line with Day et al., (2016) that using these approaches aid active participation of students, understanding of concepts and promotes collaboration. Using such approaches that are activity-based boosts students' interest in the subject as well as aid their understanding of concepts and improved performance in the subject. This also shows their adherence to the Ministry of Education's approved format for teaching Science using to improve teaching and learning of the subject at the basic level (Ameyaw-Baah et al., 2018). Their reason for their preferences is consistent with (Elliot, 2006) as cited in McLeod (2019), that students learn through interaction with their environment, peers, previous knowledge, active engagement of students in the teaching and learning process among others. This is because the teachers using these strategies and methods gives them the opportunity to interact with students through discussions and other interactive means, to know their views and ideas on concepts to be taught and build on the students prior knowledge. Also, the teachers' use of these approaches and methods agrees with Chika's (2012) opinion that using these approaches gives students the opportunity to ask questions, construct their own understanding, interact with their peers, and learn from each other in the process, while promoting collaboration or collaborative learning and

building on previous knowledge. This leads to developing creativity, critical thinking and active participation of students in the process.

4.11.5 Research Question Four

What teaching methods do Integrated Science teachers use in teaching JHS students in Accra?

Analysing the responses gathered from participants on this question revealed that teachers find the use of practical or activity-based methods in the teaching of these subjects appropriate. It reflects in their choice of methods and approaches detailed in the charts and tables above, such as grouping, peer learning, demonstration, project work, brainstorming, discussion among others which are consistent with suggestions by educational researchers that using such approaches ensure that students are practically and actively engaged in lessons, and this promotes understanding and application of concepts as well as developing other positive skills, knowledge, and attitudes in students.

Gülec and Macan (2014) for instance suggest that when students have group interactions they learn social skills, contribute to their group's work, and learn from their peers concepts that they had difficulty understanding by themselves.

Demonstration also according to Adekoya and Olatoye (2012) promotes student involvement in the teaching and learning process and helps them to experience certain concepts for the first time, learn about processes and materials and helps involve students work together co-operatively. Using of projects supports Johnson et al., (2013) assertion that students gain practical experiences while

working with ideas from the curriculum, and engaging with their peers through group discussions, sharing of ideas and presentations on their projects.

4.11.6 Research Question Five

What are the supposed appropriate teaching strategies and methods that are used by teachers to teach Mathematics in Junior High Schools in Accra?

The fifth research question sought to elicit Mathematics teacher's views or knowledge on what the supposed appropriate teaching methods and approaches are for teaching Mathematics and also to give examples of such approaches. This question is relevant because, according to Adunola (2011), poor academic achievement can be traced to the use of inappropriate methods and strategies that teachers use in teaching students.

Four of the Mathematics teachers opined that Student Centred approaches are the most appropriate for teaching the subject, followed by another four who said that Practicals was the appropriate, with two other teachers saying that the topic or concept being taught determines which methods or approaches should be used. Using Child Centred approaches is in line with what Olayinka (2016) opines that using these approaches engage students in the teaching and learning process, while helping them develop skills that make them take charge of their own learning such as research, analytical and problem solving among others as Sakata (2019) also posits. Their response that the appropriate approach or method to use is dependent on the topic or concept being taught at any particular supports Morrison, Ross, Morrison and Kalman's (2019) view that though there are various approaches and methods that are available for teachers' use, they must be applied considering various situations and for the different learning outcomes to be achieved.

The teachers' responses that student centred approaches which include demonstration, grouping, roleplay, problem based learning and active learning buttresses McKnight et al's (2016) opinion that students learn complex concepts much easier while developing interpersonal skills as they work together. Demonstration for instance, help students learn how to use tools and materials, and experience the concepts being taught practically as they work in groups (Duch, 2002). Problem Based Learning (PBL) when used in teaching mathematics helps students understand and explain mathematical concepts because it better engages them in teaching and learning activities that lead to higher performance scores (Abdullah et al, 2010),.

Zakaria, Chin and Daud (2012) also discovered that Group learning on the other hand has a better effect on academic achievement in Mathematics as students are able to learn from each other, transferring knowledge to each other by sharing what they know with each other at the peer level which makes understanding of concepts easier to achieve, this then translates in academic achievement not only at the group level but individually.

4.11.7 Research Question Six

What are the supposed appropriate teaching strategies and methods that are used by teachers to teach Integrated Science in Junior High Schools?

The responses of Integrated Science teachers were similar to their Mathematics teacher counterparts. Practicals was their most appropriate choice, Media/ Video, Demonstration and the topic determining what approach to use were other answers shared. The teachers' mention of these methods support Ameyaw-Baah et al., (2018) that the use of practical and activity-based approaches or methods promote student engagement in class and supports and that using these

methods and approaches promotes students' interest and participation in the subject, as well as their understanding of concepts McLeod (2019). Using Media and Video helps students retain what they learn through seeing, as well as practicalising abstract concepts like Vintere (2018) shares. It also helps students develop skills that help them take charge of their own learning (Sakata, 2019). The use of demonstration also helps students learn concepts practically using all their senses (Ameh & Dantami, 2012).

Teachers determining what is the appropriate approach or method to use supports the view of Adunola (2011) that teachers must consider the topic or concepts being taught to select the most appropriate for teaching any particular topic or lesson. This way teachers carefully think through and plan strategically to achieve good learning outcomes.

Doing Practicals for instance helps students work on solving real life problems while reflecting on their solutions with the supervision of a more knowledgeable making it another effective method for teaching Mathematics (Vintere, 2018).

4.11.8 Research Question Seven

What are the results of teachers' using these teaching supposed appropriate methods on the performance of students in Mathematics and Integrated Science in Junior High Schools in Accra?

The seventh research question looked at the results of using these supposed appropriate teaching methods for teaching Mathematics and Integrated Science on the performance of students. From the analyses of the responses given by participants, the views shared by teachers in both subjects were similar. A summary of Mathematics teachers responses were that;

- Helps Students Understand Concepts better
- Students are able to apply
- Encourages student participation
- Helps students gain experience and construct their own meaning
- Leads to good performance

Integrated Science teachers responses are also summarised as follow:

- Aids comprehension/understanding of concepts for application
- Makes learning, understanding and application easy
- Gives students indepth understanding and helps students apply concepts

According to Abdullah, Tarmizi and Abu (2010) problem-solving affects students' Mathematics performance positively because it promotes understanding and helps explain mathematical concepts better, whiles using grouping or co-operative learning by the teachers supports Zakaria, Chin and Daud's (2012) point that grouping helps students put their abilities together to solve problems and helps them learn from each other through the transfer of knowledge to each other at the peer level and facilitating understanding of concepts especially in Mathematics thus affecting performance positively.

Responses of Integrated Science teachers supported that of their Mathematics counterparts, they also believe that using more of interactive and student centred approaches are appropriate in teaching the subject. Furthermore, they support the use of practical and activity-based approaches or methods because these promote student engagement in class. These they say, help students learn

concepts in practical ways, so using the activity-based approaches brings comprehension and helps students apply what they have learnt successfully in tests and examinations.

The teachers add that using methods like demonstration for instance helps to translate abstract concepts into practicality or reality, thus, combining this method with discussion, observation and interactive questions and answers helps students understand so that the teacher does not teach in a vacuum.

Other teachers shared that they see the use of media such as videos impactful because they make teaching and learning science more interesting and understandable especially some topics that are purely abstract and theoretical in nature for example teaching on the solar system or elements. Instead of the teacher using solely the lecture method which will make teaching boring, using videos at least gets the attention of students and help students grasp what is being taught, which they can recall and apply when need be.

These opinions shared by the teachers in both subjects agree with Brindley's (2015) assertion that using Student or Learner Centred and Teacher Student Interactive approaches and methods such as grouping, collaborative learning, peer tutoring, problem and project-based activities, demonstration among others promote student involvement in the process of teaching and learning and leads students to discover knowledge on their own.

Also, they are effective because as the teacher acts as facilitator they direct guidance to the students level of understanding and so they are able to upgrade their knowledge and gather new knowledge which they can then apply because they were involved and actively engaged in the process, so they can apply these concepts to their everyday lives, examinations and ultimately lead to better academic achievement.

4.11.9 Challenges and limitations faced by Mathematics and Integrated Science Teachers in teaching their JHS students

One other important finding of the study had to do with Mathematics and Integrated Science teachers' challenges and limitations faced as regards their use of teaching strategies and methods which is key to the teaching and learning of these two core subjects, development of 21st Century skills, attitudes, and competences and more importantly the performance of students.

The lack of support resources such as Teaching Learning materials like graph boards and teachers' tools for demonstration for Mathematics, and the non-existence of Science and ICT laboratories equipped with projectors, computers, software, apparatus, chemicals, and other resources in most basic schools make it difficult for the teachers to utilise these constructivist approaches effectively.

Though the teachers improvise, they are unable to make the teaching and learning of the subjects as practical and activity based as possible through demonstrations and experiments to enable the students engage with these materials and equipment to give them that confidence and hands-on experience with the subjects. Practical experiments are limited to the simple ones that they can easily do, and this does not augur well for the development of problem solving and creative and innovative skills that the students must develop. The use of project and activity-based learning are very useful for teaching both Mathematics and Science (Hans et al., 2015) as cited in (Chen & Yang, 2019), however, their use is limited because of the challenges mentioned above though they help students construct new knowledge (Oguz-Unver & Arabacioglu, 2014), as well as creating products and solving problems. Some of the challenges shared by teachers especially Integrated Science teachers give credence to findings of Assafuah-Drokow (2018) on challenges faced by Integrated Science teachers in the teaching and learning of the subject.

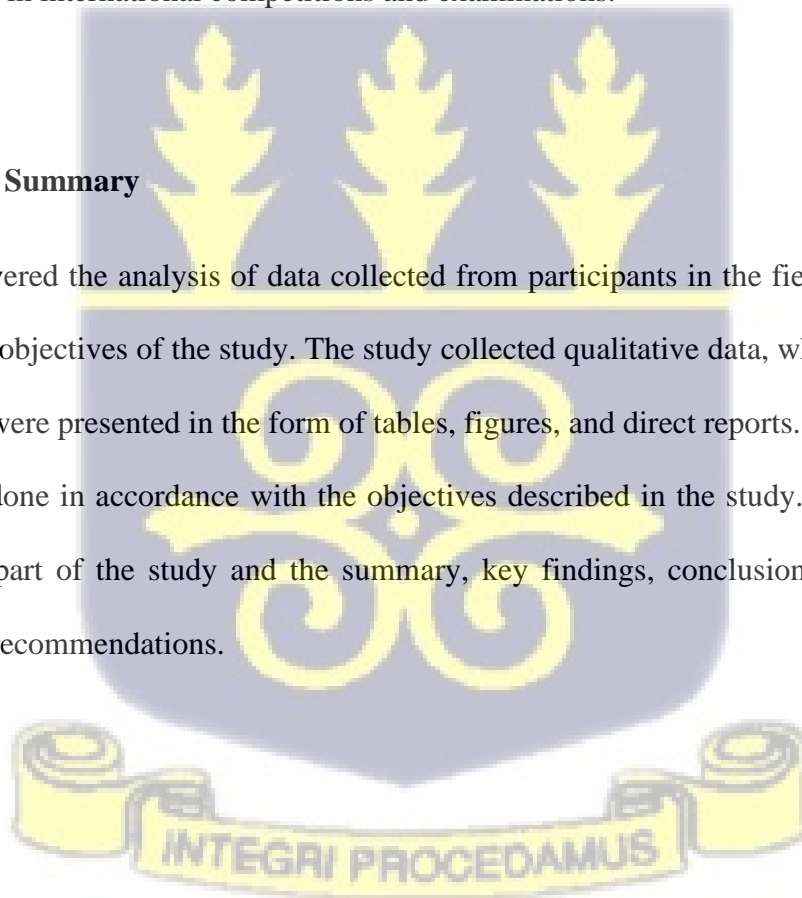
This explains why methods like grouping, brainstorming and discussions are the most used, whereas inquiry, project based, discovery learning could also be used in teaching the subjects to challenge students to stretch their research, creativity, and problem-solving skills.

The falling and abysmal performance of students in the subjects both locally and internationally can be attributed to the challenges teachers in both subjects have using the practical and activity based methods, and it is high time that stakeholders in education take more drastic measures to see that the teaching and learning of these subjects are done to international standards in order to bring students to the level that they improve in the subjects and meet international standards when they have to take part in international competitions and examinations.

4.13 Chapter Summary

This chapter covered the analysis of data collected from participants in the field and considered the purpose and objectives of the study. The study collected qualitative data, which was analysed by themes, and were presented in the form of tables, figures, and direct reports.

All these were done in accordance with the objectives described in the study. The next chapter covers the last part of the study and the summary, key findings, conclusions, contribution to knowledge and recommendations.



CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter examines the results of the study, findings, the recommendations suggested from the study and the conclusions drawn from the results of the study. All of this was consistent with the objectives of the study and the research questions raised for the study.

5.2 Summary of Findings

The study aimed at finding out JHS Mathematics and Integrated Science teachers' use of teaching strategies, ascertain their views on the supposed appropriate teaching strategies and methods for teaching these two subjects and the impact of using these approaches on the performance of students and the challenges that teachers face teaching their subjects.

In all twenty teachers comprising ten (10) Mathematics and ten (10) Integrated Science teachers were interviewed using a semi-structured questionnaire and recordings made to gather information on teachers' use of teaching strategies in Mathematics and Integrated Science. Observation of the teachers in class was also done to confirm their use of teaching approaches shared in the interviews with them. Analysis of data was done using descriptives, narratives, participant quotations and summaries. Teachers had teaching experiences ranging from 1 to 23 years for Mathematics teachers and had 4 to 23 years for Integrated Science teachers.

Again, four (4) of the Mathematics teachers had trained professionally as teachers prior to their teaching career, while six (6) of Integrated Science teachers had had professional teacher training before their career.

At the end of the study, it was found out that teachers not only had knowledge in teaching strategies and methods, but also found them beneficial for both teachers and learners and giving teachers a plan of processes to follow to impart knowledge in order to promote understanding of concepts by students and achievement of learning outcomes by teachers.

The findings of the study further showed that five (5) out of the ten Mathematics teachers sampled use Teacher Student Interactive approaches, followed by two (2) who use Student Centred strategies. Another two (2) of Mathematics Teachers use a combination of Teacher Student Interactive and Student Centred strategies, with one (1) using a combination of Student Centred and Teacher Centred approaches.

Again, the findings show that Mathematics teachers use a combination of methods such as grouping, demonstration, role play or drama, brainstorming and lecture. From the Mathematics teachers' responses nine (9) of the teachers use grouping methods, followed by five (5) who use demonstration and two (2) for Role play and one for Lecture.

Interactive methods were the most used of the strategies by Integrated Science Teachers with five (5) of the teachers using the approach. Another two (2) of Integrated Science teachers preferred to combine Teacher Student Interactive and Student centred approaches. Another one (1) used all three strategies, teacher centred, student centred and teacher student interactive, with another one (1) teacher each using Teacher Centred and Teacher Student Interactive and Teacher Centred and Student Centred respectively.

Grouping tops the most used method with six (6) of the ten Integrated Science teachers sampled using the method, followed by project/activity with five (5) teachers, demonstration with three (3), followed by Lecture with two (2). Outdoor, roleplay, discovery and discussion were used by only one (1) of the teachers each.

Grouping, demonstration, project, and activity and practical based methods, role play, media among others are preferred by teachers in both subjects because of the advantages of using these approaches for teaching.

Teachers prefer these approaches because they help them engage students through interactions between themselves and their students and also the students among themselves. These interactions with the students help teachers ascertain their students relevant previous knowledge on concepts to be taught and build on it. Again, the use of these methods helps students contribute in class and to their group's work in class, as well as develop skills such as research and teamwork as they discuss and work collaboratively on group projects. Demonstrations and other practical and activity-based learning helped students gain hands on experiences that help them recall and explain concepts in their own words.

Added to all these, the study also found out that although the teachers know and use strategies that are appropriate for teaching these subjects, they have limitations to using them because of a lack of supporting resources that would enable them use these methods fully. Majority of schools do not even have science and ICT laboratories that are equipped with chemicals, equipment, and tools to do practical work and practical demonstrations with students. Teachers improvise to do only simple experiments with students which are not sufficient to give the students full experiences with equipment and processes as a whole. Mathematics teachers for instance complain of not having instruments and graph boards for demonstration. Science teachers are also not able to use

certain methods because they do not have all that it takes to use them. This is a major issue that affects students' knowledge in Mathematics and Integrated Science. They should be taught in a way that gives them holistic knowledge in the subjects and not limited in anyway.

This could account for why our students are unable to meet international benchmarks or standards for TIMSS for instance and are found in the lower ranks in such competitions as raised in the statement of the problem in Chapter 1. This is why performance is also deteriorating as is being recorded over the years as cited in the WAEC Chief Examiners reports of 2012, 2015, 2017, 2018 and 2019 on the local front as well as their abysmal performance on the international front. Whereas their counterparts elsewhere enjoy the full benefits of teaching strategies, they are limited and this explains the shortfall irrespective of the efforts of the teachers of these subjects.

The Key findings of the study are summarised as follows:

1. The study established that teachers of Mathematics and Integrated Science use predominantly constructivist approaches such as Teacher Student Interactive and Student Centred in combination with Teacher Centred approaches to teach students in these subjects.
2. Also, the teachers use mostly constructivist teaching methods such as grouping, demonstration, discussion, brainstorming, project, activity, and roleplay with discovery and outdoor. The Lecture method is minimally used.
3. Again, teachers have challenges/limitations using methods such as project, outdoor, discovery learning that they find to be effective and beneficial in teaching Mathematics and Integrated Science due to lack of support resources such as well-equipped ICT laboratories, Science laboratories, apparatus, chemicals among other, which affects the teaching, learning and performance of students in the subjects.

4. Teachers are only able to do simple experiments by improvising because of a lack of equipment.

5.3

Conclusion

In view of the above-mentioned findings of the study, it is concluded that Mathematics and Integrated Science teachers in the Accra Metropolis find the use of constructivist approaches most beneficial in teaching their subjects. This is evident in their predominant use of Teacher student Interactive and Student Centred methods especially grouping and demonstration, discussion, brainstorming, role play, project work among others for teaching their subjects.

The lack of teaching aids, materials, audio visual equipment, laboratory equipment and chemicals, and other resources pose a big challenge for teachers of these subjects, as they are handicapped in teaching their subjects. Thus, they are limited in the extent to which they can practice the use of these constructivist strategies. For instance, practical activity such as experiments are limited to very simple ones, mathematics teachers are forced to use students' equipment to demonstrate instead of teachers equipment, videos and pictures cannot be shown in class because most schools are not privileged to have computer laboratories or science laboratories. Students cannot research on topics as pertains elsewhere and outdoor activity and excursions to promote outdoor, discovery, project and inquiry-based learning for instance are nonexistent, though these methods engage students more and help them develop research, analytical and creative skills. All these have implications for stakeholders to take some radical steps to help improve the teaching and learning

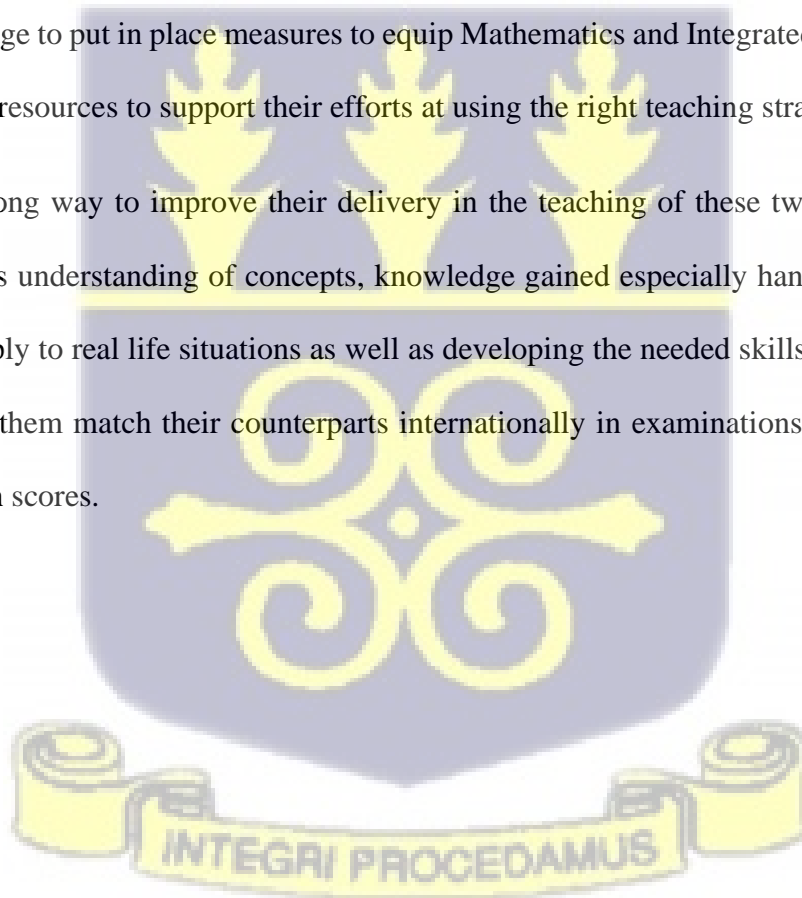
of the subjects in order to improve performance of students in these subjects not only on the local front but internationally.

5.4 Contribution to knowledge

Although a lot of studies exist on the topic under discussion internationally, the same cannot be said for the local front as regards teachers' use of teaching strategies in Mathematics and Integrated Science at the JHS level, studies in this area are scanty.

The findings of the study contributes empirical knowledge on the strategies and methods that teachers in these core subjects use and their impact on performance. Educational stakeholders can use this knowledge to put in place measures to equip Mathematics and Integrated Science teachers with the needed resources to support their efforts at using the right teaching strategies.

This will go a long way to improve their delivery in the teaching of these two core subjects to improve students understanding of concepts, knowledge gained especially hands on experiences that they can apply to real life situations as well as developing the needed skills and competences that will enable them match their counterparts internationally in examinations and competitions and achieve high scores.



5.5 Recommendations

Following the findings of the study, the following recommendations have been suggested:

1. Consistent training must be given to teachers in Mathematics and Integrated Science to further their use of constructivist teaching approaches of Interactive and Student Centred approaches and methods, especially enquiry-based, co-operative and differentiated learning as stated in the curriculum.
2. Mathematics teachers and classrooms to be equipped with supportive resources like TLM's such as Graph Boards and Teachers' instrument to facilitate effective demonstration of concepts.
3. Government should ensure that JHS have well equipped classrooms, Science and ICT laboratories that are well equipped with the necessary gadgets, tools, equipment, and chemicals to ensure holistic and practical and activity-based teaching and learning of Integrated Science to achieve best results.
4. Government to ensure that teachers' resource centres are set up in the educational circuits where teachers can get TLM's and basic teaching resources to support teaching and learning of the subjects so that schools in even the deprived communities can have access to these educational materials.

5.6 Implications for Further Studies

The researcher suggests the following for further studies on the topic for future studies. This study focused specifically on Ablekuma South Sub Metropolitan District in Accra, but it can be repeated

in other Districts in Accra or possibly country-wide so that a nation-wide report can be obtained on the topic. This would lead to country-wide interventions for teachers in these core subjects.

This study focused on only teachers but another study can focus on students and look at their preference for teaching strategies in teaching the subjects and how they impact their study and performance in the subject.



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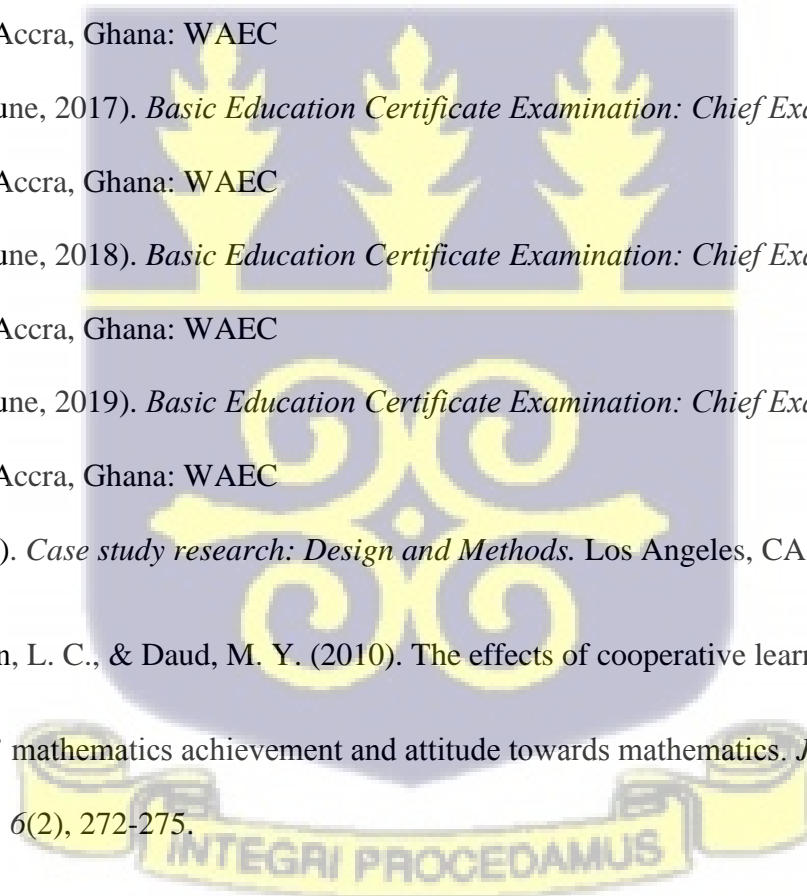
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APPENDIX A



UNIVERSITY OF GHANA
DEPARTMENT OF TEACHER EDUCATION
SCHOOL OF EDUCATION AND LEADERSHIP

Ref. No.: SEL/DTE. 7

July 12, 2021

The Metro Director,
Ghana Education Service,
Ablekuma South Sub-Metro,
Accra.

Dear Sir/Madam,

LETTER OF INTRODUCTION:
MADAM EARLINE ASARE BOWELLEH (ID: 10010444)


I write to introduce to you **Earline Asare Bowelleh** an MPhil student of the Department of Teacher Education, School of Education and Leadership, University of Ghana for the 2020/2021 academic year.

As part of the requirements for completing the programme, she is undertaking a research on the following topic:

“Teachers’ Use of Teaching Strategies in Mathematics and Integrated Science in Junior High Schools in Accra: A Case Study of Ablekuma South District.”

I would be most grateful if you could extend to the student all the assistance required to enable her to conduct the study.

Yours sincerely,


Prof. Jonathan Fletcher
Acting Head of Department



COLLEGE OF EDUCATION

P. O. Box LG 1181, Legon, Accra, Ghana.
• Tel: +233 (0)303 934 692 / 0502 673 636 • Email: teachered@ug.edu.gh • Website: www.ug.edu.gh/ted



APPENDIX B

UNIVERSITY OF GHANA

ETHICS COMMITTEE FOR THE HUMANITIES (ECH)

P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No...ECH 173/ 20-21 ...

July 13, 2021.

Earline Asare Bowelleh
Department of Education
University of Ghana
Legon

ETHICAL CLEARANCE (ECH 173/ 20-21)

The protocol title below has been reviewed and approved by the ECH Committee.

TITLE OF PROTOCOL: TEACHERS' USE OF TEACHING STRATEGIES IN TEACHING MATHEMATICS AND INTEGRATED SCIENCE IN JUNIOR HIGH SCHOOLS IN ACCRA: A CASE STUDY OF ABLEKUMA SOUTH

PRINCIPAL INVESTIGATOR: EARLINE ASARE BOWELLEH

Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation. Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid till July 12, 2022. You are to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,

Professor C. Charles Mate-Kole
ECH Chair

Cc: Dr. Abraham Okrah, Department of Teacher Education, UG
Tel: +233-303933866 Email: ech@ug.edu.gh

APPENDIX C

GHANA EDUCATION SERVICE

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

My Ref. No: GES/PG 48 V13

Your Ref. No:



Republic of Ghana

METRO EDUCATION OFFICE
POST OFFICE BOX 337
ACCRA

Tel. No.: 030-2632370
030-2676199
054-0480229

Email: metroeducationoffice@gmail.com

29TH JULY, 2021

**ALL HEADTEACHERS
(ABLEKUMA SOUTH)
ACCRA METROPOLIS**

LETTER OF INTRODUCTION TO CONDUCT RESEARCH EARLINE ASARE BOWELLEH - UNIVERSITY OF GHANA

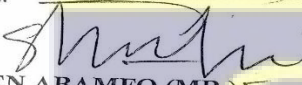
I write to introduce **Earline Asare Bowelleh**, a final year MPhil student of the Department of Teacher Education, School of Education and Leadership from the above institution.

Earline Asare Bowelleh as part of her requirements for the partial fulfillment of the award of degree, is expected to conduct and present a research to the University. Her topic is: *"TEACHERS' USE OF TEACHING STRATEGIES IN MATHEMATICS AND INTEGRATED SCIENCE IN JUNIOR HIGH SCHOOLS IN ACCRA: A CASE STUDY OF ABLEKUMA SOUTH DISTRICT"*.

Permission has therefore, been granted for **Earline Asare Bowelleh** to collect data on Teachers in Ablekuma South in Accra Metropolitan Directorate of Education.

By this letter, the researcher is directed to contact you for further directives. Kindly ensure that teachers assist her to fulfill this academic requirement. Meanwhile you are entreated to ensure that contact hours are not compromised.

Thank you.


**STEPHEN ABAMFO (MR.)
DIRECTOR OF EDUCATION
ACCRA METRO**

Cc: The Circuit Supervisor, Korle Gonno, AMEO, Accra
The Circuit Supervisor, Mamprobi, AMEO, Accra
The Circuit Supervisor, Ojoo, AMEO, Accra
Earline Asare Bowelleh, University of Ghana, School of Education & Leadership, Accra



APPENDIX D

Interview Guide

Demographic Information of Participants

What subject do you teach?

How long have you been teaching this subject?

Is this the only class you teach?

What has the experience been like?

What is your educational qualification?

General Questions

1. What is your general view on teachers using teaching strategies or teaching methods when teaching their subjects?
- 2(a). Do you think they make any impact on teaching, for example, do they make teaching the subject or lesson easier?
- 2(b). What about helping the student understand what is being taught?

Main Questions

3. What category of teaching strategy would you say you use in teaching your subject or lessons? Are they teacher centred, student centred or teacher student centred? Why do you say so?

- 3b. Describe how you use them practically to teach your subject or lessons?
4. What teaching method or methods do you use in teaching your subject or lessons and why do you use those particular strategies?
5. Do you use different strategies for teaching different aspects of the subject or lessons, or you stick to just one?
6. Do you know if there are any appropriate teaching strategies that must be used when it comes to teaching your subject area? Mention some of them?
7. Why do you think these strategies work best for teaching this subject? Do they have any special impact than other strategies?
8. What challenges do you have teaching your subject?





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