UNIVERSITY OF EDUCATION, WINNEBA

PERFORMANCE OF STUDENTS WITH VISUAL IMPAIRMENTS IN MATHEMATICS IN GHANA NATIONAL AND ST. JOSEPH BASIC SCHOOLS IN GHANA

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of the requirements for the award of the degree of Master of Philosophy (Special Education) in the University of Education, Winneba

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DECLARATION

Student's Declaration

I, Emmanuel Agyei, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work which has not been submitted, either in part or whole for another degree elsewhere.

Signature ……

Date……

Supervisor's Declaration

I hereby declare that the preparation and presentation of this thesis was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

DR. AWINI ADAM **(Supervisor)**

Signature ……

Date……

DEDICATION

This thesis is dedicated to my parents Elder Joseph Kwarfo and Deaconess Veronica Kwarfo for their incessant prayer support and encouragement.

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ABSTRACT

This study employed sequential explanatory design to find out the performance of students with visual impairments in mathematics in the Ghana National and St. Joseph Basic Schools in Ghana. Sixty students with visual impairments and two mathematics teachers were purposively sampled for the study. Documentary analysis, questionnaires and one-on-one interview were used to elicit data for the study. The data gathered were analysed using descriptive statistical tools such as simple percentages, frequency, mean and standard deviations. The results of the study revealed that the performance of students with visual impairments in mathematics was below average. The findings also revealed that the students' performances in multiplication and division were low. The findings further showed that, teachers' and students' attitude, teachers' pedagogical content knowledge in mathematics, class size, non-availability and inadequacy of teaching and learning resources were some of the factors that hampered students with visual impairments' performance in mathematics. Additionally, the findings showed that, recruitment of more qualified mathematics teachers, verbal descriptions of instructions and adaptation of mathematics materials were some of the strategies that could be adopted to improve the performance of the students. It was recommended that the Ghana Education Service (GES) should collaborate with school heads to organize in-service training, seminars, and workshops for regular education teachers on how to teach mathematics to students with visual impairments.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Mathematics is a field of study which requires the use of vision considering its language, thus directions, quantity, and shape (Maltese, 2006). However, there should be no reason why a learner of sufficient capability should fail to become a successful mathematician simply because he or she is visually impaired. Mathematics, as a subject, seems to be known as an essential area of learning designed to drive economies and scientific transformation of any society. Enu, Agyeman and Nkum (2015) perceived mathematics as a subject that affects all aspects of human life and at different levels. This implies that before a student or an individual with visual impairments can function well in modern day technology-driven society, he or she must possess relatively good knowledge of mathematics.

According to Smith (2004), learning mathematics leads to development of logical and critical reasoning and develops analytical and problem-solving skills to a high degree. In modern times, adoption of mathematical methods in the social, medical and physical sciences has expanded rapidly, confirming mathematics as an indispensable part of all school curricula and creating great demand for university-level mathematical training (Oloo, Mutsotso, & Masibo, 2016). It is therefore no denying fact that the performance of students in mathematics needs to be investigated at the basic school level to know whether students with visual impairments are performing well in mathematics or not since mathematics is essential area to all students. In this study, the performance of students with visual impairments in mathematics was conceptualized in three ways: (a) the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in

Ghana, (b) factors that influence the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana, and (c) strategies needed to improve the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana.

Performance in mathematics is essential for the individual's positive outcome in other disciplines and it comprises not only one aspect but rather both on behavioral and an outcome aspect. The behavioral aspect refers to what an individual does in the work situation, such as teaching basic mathematics operation to basic school learners while outcome aspects of performance may depend on factors other than the individual's behavior (Sonnentag & Frese, 2002). To perform is to produce valued results and the level of performance depends on six components: (a) context, (b) level of knowledge, (c) levels of skills, (d) level of identity, (e) personal factors, and (f) fixed factors (Don, n.d.). Although it is generally believed that the performance of students with visual impairment in mathematics is low (Kapperman & Sticken, 2004; Megan, 2012), there are other studies that revealed otherwise. Lynn (2012) found out that students with visual impairments were generally more likely to earn passing scores and less likely and consistently to earn non-passing scores for both reading and mathematics on a high-stakes tests. Lynn (2012) further reported that, although inequality exists between the performance levels of students with visual impairments and so called "normal students," the overall performance assessment in mathematics among students with visual impairments was encouraging.

Educationally, there are different factors that affect the learning of subjects and concepts by students, and these factors may vary from subject to subject. Peer support, students' and teachers' perceptions of mathematics, teachers' and learners' attitudes, teachers' qualifications, culture, facilities, equipment and family issues are

some of the factors that affect students' performance in mathematics in second cycle education (Adino, 2015; Enu, et al, 2015). There may be many other factors that affect students with visual impairment in their performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. This study focused on finding out among others, the factors that affect the performance of students with visual impairment in these schools. These two schools were chosen for the study because they form part of the few schools which is practicing inclusive education for the past thirteen years. Also, they were the only schools situated near special schools; namely, Cape Coast School for the Deaf and Bechem School for the Deaf, respectively that enrolled students with visual impairments from unit schools.

In general, students do encounter challenges in mathematics of which students with visual impairments are of no exception. Ramani (2004) and Sirin (2005) concluded in their studies that regardless of the significant role that mathematics plays in society, students have always faced challenges in their performance of mathematics. Similarly, other studies such as Mazana, Suero, Montero, and Olifage (2019) have affirmed, that self-confidence, poor background, fear and lack of seriousness are some of the challenges students encounter in learning mathematics and the need to improve in this subject area. It is against this backdrop that the researcher sought to find out strategies that could be put in place to help to improve the performance of students with visual impairment in mathematics in the two selected schools.

1.2 Statement of Problem

Mathematics is a core subject from basic school level to secondary school level in Ghana. Students with visual impairment in basic schools are expected to obtain a pass mark in mathematics in other to gain admission to the senior high schools. In spite of the fact that many studies have reported on the poor performance of students with visual impairment in mathematics (Kapperman et al, 2004; Megan, 2012), some researchers are of the opinion that students with visual impairment can perform well in mathematics like their sighted peers (Lynn, 2012). Although Lynn (2012) reported positively on the overall performance assessment in mathematics among students with visual impairments, the level of performance of students with visual impairment at Ghana National and St. Joseph Basic Schools in Ghana has not been establish by any empirical study.

Also, much is not known about the factors that influence the performance of students with visual impairment in mathematics at the selected basic schools even though some studies conducted in different locations have revealed teachers' and students' attitudes towards mathematics, teachers' qualification, teachers' and students' perception of mathematics subject, knowledge teachers have about the students and the subject, class-size, environmental noise, societal and family issues as some factors that might influence students' performance in mathematics (Adino, 2015; Enu, et al. 2015; Oloo, et al., 2016).

In addition, measures put in place by teachers and other stakeholders in improving the performance of students in mathematics at the selected basic schools cannot be ascertained without finding out from the stakeholders. Studies have established that, homework, resource teachers and peer support, are some of the measures that could help improve the performance of students in mathematics

(Jackson, 2010; Maguvhe, 2015). However, these findings may not be the same measures or strategies in improving the performance of students with visual impairment in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. These uncertainties have aroused the curiosity of the researcher to conduct the present study at exploring the performance of students with visual impairment in mathematics at the two selected basic schools.

1.3 Purpose of the Study

The purpose of the study was to explore the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana.

1.4 Objectives of the Study

The objectives of the study were to:

1. Find out the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana.
2. Identify factors which influence the performance in mathematics of students with visual impairments in Ghana National and St. Joseph Basic Schools in Ghana.
3. Recommend strategies that could be adopted to improve the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana.

1.5 Research Questions

The following research questions were raised to guide the study:

1. What is the level of performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana?

2. What factors influence the performance of students with visual impairments in mathematics at Ghana National and St. Joseph Basic Schools in Ghana?
3. What strategies could be adopted to improve on the performance in mathematics by students with visual impairments in Ghana National and St. Joseph Basic Schools in Ghana?

1.6 Significance of the Study

The findings from this study would help in revealing the nature of performance in mathematics among students with visual impairments at the basic schools' level. This would inform teachers, Ministry of Education (MOE) and other stakeholders to organize activities towards improving the performance of the students, if necessary. The findings would also bring to light the factors influencing the performance of students with visual impairments in mathematics and would also inform teachers to identify and evaluate their teaching approaches and adopt strategies that improve performance in mathematics instruction. In addition, the findings would help to identify strategies that would improve the performance of students with visual impairments' in mathematics. This would also enable teachers and other stakeholders to make necessary provisions available to students with visual impairments to promote their performance in mathematics. Finally, the findings of the study would also add to existing literature for any researcher interested in similar studies.

1.7 Delimitations of the Study

Even though, there were students with visual impairments in other basic schools in Ghana, this study focused on only students with visual impairments at Ghana National and St. Joseph Junior High Schools (JHS 1-3) in Ghana. The reason was that they were inclusive basic schools in Ghana, in which students with visual

impairment have written the BECE for more than ten years, and their performance in mathematics seemed to be abysmal. Pupils with visual impairments from nursery to class six (6) were not included in the study because the study considered only students with visual impairments who had one or three years learning experience in mathematics in Ghana National and St. Joseph Junior High Schools in Ghana.

Also, these two schools had been identified in those areas for the past thirteen years to conduct a pilot project, which would determine the success or otherwise of inclusive education in Ghana. Additionally, the two schools were the only schools that were situated near special schools where they could use their hostels.

Furthermore, the schools enrolled students with visual impairments, so the researcher used these teachers because of their experiences in working with students with visual impairments over several years. The students were used because the study was about them and they could help the researcher with accurate information about themselves. The findings of the study were not generalized to other schools outside these two schools in the country. Finally, based on the findings, strategies that, if adopted, could help improve the performance of students with visual impairments in mathematics were developed.

1.8 Limitation of the Study

There were difficulties getting the students' class exercises for the analysis. The researcher overcame this challenge by waiting for three semesters to elapse so that he could obtain different class assignments and exercises for the analysis. This delayed the data collection period. In addition, some of the literature were difficult to get. In spite of those limitations, the outcome of the study was not significantly affected.

1.9 Operational Definition of Terms

Performance: achievement of specific goals or objectives set in any academic undertaking in basic mathematics.

Mathematics: mathematics is the science that deals with the logic of shape, quantity and arrangement.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In this chapter, the researcher reviewed relevant literature about the study from books, the Internet, journals, and articles. This was done under the following strands:

- Theoretical framework
- Performance of students with visual impairment in mathematics
- Factors that influence the performance of students with visual impairments
- strategies that would improve students with visual impairments' performance
- Summary and Research Gaps

2.1 Theoretical Framework

The Theory of Performance underpinned this study. This theory was developed by Don Elger (n.d) who posited that, "to perform is to produce valued results whether as an individual or as a group engaged in a collaborative effort (p. 11)". Don Elger further indicated that performance is a journey that a person undertakes. Although performance is a journey, yet, it could be influenced by some persuasive factors which may include the performer or other individuals (Don Elger, n.d.). Don Elger explained further that the level of performance of an individual in a discipline or in an activity largely depends on six holistic components. They include context, level of knowledge, level of skills, level of identity, personal factors and fixed factors. The context component involves an individual's maturity in a discipline on a shared identity in a professional community while elevating his/her own uniqueness. The level of knowledge describes specific actions that are used by individuals or groups in multiple types of performances. Level of skills talk about

knowledge in the form of information, concepts, theories, or principles acquired by a person or group through experience or education. Level of identity includes variables associated with the situation that the individual performs. Personal factors include variables associated with a personal situation of an individual. Lastly, fixed factors include variables unique to an individual that cannot be altered.

As the study sought to investigate the performance of students with visual impairment in mathematics, the implication of the theory to the study could be associated with the context component to describe the performance of students with visual impairment as the number of years they have studied the subject. Also, the level of knowledge acquired by students in mathematics could determine their performance as described by Don Elger. Moreover, the performance of students with visual in mathematics could largely be determined by the skills they have attained through education or experience, and how they have been able to apply such skills in a real life situation. According to the theory of performance, what is to be noted is that, performance of students which include those with visual impairment could be determined by their personal situation or circumstances inherent in the individual in whatever way possible which not altered, could be a fixed factor.

Highlighting on the factors that influence performance, Bandura (1997) explained that, contemporary psychologists agreed that attitudes are among the factors that influence students' performance. Besides, the attitude of teachers and students towards mathematics as a factor that influences students' performance in mathematics, there are other teacher-related factors (such as teachers' qualification, teachers' knowledge in teaching mathematics to students with visual impairments), student- related factors (such as students' attitudes, peer support) and school-related factors (such as class-size, environmental noise, the nature of mathematics

curriculum) that have influence on students with visual impairment performance in mathematics (Adino, 2015; Enu et al, 2015; Oloo et al., 2016). Moreover, although performances are influence by some factors but studies by Evans (2013), Jackson, (2010) and Maguvhe (2015) revealed that when strategies such as heuristic approach, teachers' in-service training, parental support are put in place it will enable the students to understand the concepts and improve their achievement in mathematics. It can therefore be said that with sufficient understanding of the structure of a field of knowledge, advanced concepts can be taught appropriately to students with visual impairments and improve their performance in mathematics.

2.2 Performance of Students with Visual Impairment in Mathematics

According to the Chief Examiner's report of the Ghana Education Service (2016) on students' performance in mathematics in the Basic Education Certificate Examination (BECE) students performed abysmally in mathematics of which students with visual impairments are of no exception. This could be traced to factors attributable to teachers, school facilities, methods of teaching, teaching and learning materials, and lack of support needed to enhance their performance in mathematics. The report further cited construction of triangles, calculating of angles, constructing a frequency distribution tables and transformation as the main areas that students with visual impairment failed the most, hence, needed much attention. The Chief Examiner again recommended that students should be given adequate preparation in the form of exercises and their reports must be assessed and evaluated by teachers.

To determine the performance of students with visual impairments in mathematics, numerical operations are essential areas of the mathematics curriculum that one must considered. If students can select and apply various computational methods, including mental mathematics, estimation, paper-and-pencil techniques, and the use of calculators, the students must understand how to add, subtract, multiply, and divide whole numbers, fractions, and other kinds of numbers (Jenna, Sarah & Stephanie, 2009). Amato, Hong and Rosenblum (2013) conducted a study of 196 teachers of students with visual impairments. The participants completed an online survey on how they decide which students should be taught abacus computation skills and which skills they teach. The results of the participants show that, when students with visual impairments were provided with instruction in abacus computation, the most frequently taught skills were the operations of addition and subtraction because the students get addition and subtraction skills easier than multiplication skills. To understand the concept of multiplication and division, ideas related to addition and subtraction is a critical step in establishing deeper understanding. This is because having competency with number combinations for example (3+5=8; 10-6=6) had been shown to give students a significant skill pertaining to procedural computation and world-problem (Fuchs, Compton, Powell, Seethaler, & Capizzi, 2006).

However, students failed when they had to relate multiplication to a context Kaufmann (2010). This implies that students with visual impairment understand and can perform better in addition and subtraction operations as compared to multiplication. Good performance in addition and its inversely related operation, subtraction, are powerful foundational concepts in mathematics, with applications to many problem situations and connections to many other topics.

2.3 Factors that Influence the Performance of Students with Visual Impairments

Adino (2015) used the descriptive survey design to establish factors influencing students' performance in mathematics in Kenya Certificate of Secondary Education (KCSE) in public secondary schools in Butere sub-county. The four research objectives were to determine whether the teachers' in-service training influences students' performance in mathematics in KCSE, the teachers and students' attitude towards mathematics in KCSE and availability of resources. The study targeted 26 Principals, 45 mathematics teachers and 192 students in Butere sub-county. Simple random sampling technique was used to select the study participants. Data was collected by use of questionnaire and analyzed using descriptive statistics. Findings revealed that non-availability and inadequacy of teaching and learning resources hampered performance in mathematics. Research findings also showed that the teaching methodologies influenced performance as well. Findings on the influence of learners' attitude in mathematics revealed that learners had positive attitude towards the subject. The study recommended further that the study must be undertaken in both public and private schools in other sub-counties in Kenya to establish the factors that result to poor performance in mathematics. The ministry of education should invest in providing teaching/learning resources for mathematics.

Various factors influence the performance of students in mathematics according to the findings of Adino (2015) but in this study, the factors that seem to influence students with visual impairments' performance in mathematics have been grouped into three main factors: teacher-related factors, student-related factors and school-related factors.

2.3.1 Teacher-related factors

While referring to mathematics performance, Mason (2003) observed that teachers were taking a critical approach in their teaching and were thus unable to achieve high outcomes in their teaching. Mason further explained that teachers are failing their role in terms of students' performance in mathematics that is being technical managers of instruction, material, and activity. Teachers should be at the fore front in being technical managers of instructions, material and activity and they should not avoid this as it is part of their teaching profession. Talking about students' performance in mathematics, teachers play an important role. Waihenya (2000) in his study stated that students normally blame their teachers for poor performance in mathematics and sciences subjects. This is because teachers always concentrate on the few students they have recognized as good in the subject mathematics while putting off those who are weak in mathematics. This behavior of the teachers has been one of the factors influencing students' performance in mathematics (Waihenya, 2000).

In the study of Sila (2014) it was revealed that the problem of poor mathematics performance lies with the instructor, training process, ability to adapt to changes in curriculum and lack of opportunity for skill improvement. Students learning mathematics normally do so with assistance from their class teachers. In the experiment of Grouws (2004) in mathematics teaching, it was found that teachers who engaged in active teaching practices had students who performed better in terms of basic skills but not problem solving. Notable among the conceptual critiques was the lack of attention given to subject matter and to how the subject is being taught. This implies that mathematics teachers who teaches students with visual impairments should make sure that the activities selected in the teaching and learning of mathematics must nurture plenty of student with visual impairment's activities and

their acquisition of learning skills and that an enabling environment should be created to give the students with visual impairment the opportunity to interact freely with their fellow peers or students. Teaching methods, teacher qualifications, subject majors and the years of experience as teachers who teaches mathematics can be predictors of students with visual impairment mathematics achievement. The following are some of the teacher-related factors that seem to influence students with visual impairments performance in mathematics.

2.3.1.1 Teachers' attitudes towards mathematics

Teachers' concerns about mathematics can significantly affect their ability to teach mathematics as a subject while their attitudes towards the subject may significantly affect how they perceive their own competence in mathematics. Attitudes refer to individual prevalence to respond favourably or unfavourably to an object, person or group of people, institutions, or events (Mwangi, 2014). Wasiche (2006) also defines attitude as a feeling towards something or somebody which is sometimes reflected in a person's behaviour. Attitudes formed by an individual mostly depends on his/her experience in the learning environment and it enhanced by interpersonal interaction (Jackson, 2010). Zan and Martino (2007) explained that attitude towards mathematics is just a positive or negative emotional disposition towards mathematics. According to van der Sandt, (2007) teachers' attitudes regarding mathematics is relative to attitude towards the teaching of mathematics which in turn has a powerful impact on mathematics teaching. According to Koehler, Mishra, Akcaoglu, and Rosenberg (2013) teachers' attitudes towards mathematics is one of the most important factors in developing learners' mathematics ability. If teachers attribute success or failures of students to themselves, then they will do something to overcome the problem. If on the other hand, the reason that learners

succeed or fail lies within learners, then the teachers do not feel as much responsible for the failure.

Rhodes University Mathematics Project (RUMEP) research finding indicated that if teachers felt enthusiastic and confident, their attitudes towards delivering content will have positive influence, hence they teach more effectively (Spanneberg, 2001). This shows that the way teachers' present contents of mathematics will determine the benevolence of attitude teachers have towards the mathematics content. This implies that many teachers may still struggled with the whole question on whether it is the process or content that is important for effective learning which can led to the formation of attitude on the content on the side of the teachers. This can affect the perception teachers would be having towards mathematics as a subject. In this study, it could be seen that the attitude formed by teachers who teach mathematics to students with visual impairments might have a direct impact in the manner in which one will handle mathematics as a subjects when delivering it in classroom. Though there are forms of attitude that influence individual but in this study the researcher was to look at what could be the sources of negative or positive attitudes of teachers towards the performance in mathematics among students with visual impairments.

In the study of Kassie and Jayaprada (2012) on teachers' attitudes towards inclusive teaching to students with visual impairment in English language teaching setting; it was revealed that attitude of teachers, remains the ultimate challenge since it is influenced by many factors. For example, when resources and proper training are not available, negative results concerning attitudes toward students' performance is likely to happen. Hence, for the successful performance of students with visual impairment in mathematics, teachers' attitude towards teaching mathematics to

students with visual impairments should be looked at since their negative attitude towards mathematics may negatively influence students with visual impairment performance in mathematics. From this perspective, it is also equally important that assessing teachers' attitudes towards mathematics is vital in providing teachers with the training and support to enable them meet the challenge successfully (Kassie & Jayaprada, 2012).

According to Bridget, Vemberg, Twemlow, Fonag, and Dill (2008) students with the devoted teachers have the courage and determination to face difficulties in school life. Teachers are recognized as those who provide support and encouragement to students to value, love or remove unwanted behavior (Bridget et al., 2008). Teachers must therefore have in mind that they are role models whose attitude or behaviors are easily imitated by students. Yara (2009) explained that, many teachers do not frequently realize that their behaviors and how they interact with students can be more vital than what they teach. Bridget et al. (2008) added that what teachers like or dislike and how they feel about their learning could have effect on their students. Like all other kinds of attitude, a teachers' attitudes towards mathematics can be measured by the emotional response towards mathematics (affective), beliefs about mathematics (cognitive), as well as behavior (Mensah, Okyere, & Kuranchie, n.d.). Emotional responses toward mathematics that are found in teachers include like and dislike of mathematics, anxiety associated with mathematics and self-confidence in relation to mathematics (Brady & Bowd, 2005; Henderson & Rodrigues, 2008).

Teachers' attitudes towards mathematics are important yet, few teachers may themselves express negative attitudes towards mathematics which result in encouraging their students to pursue higher levels of education but not in mathematics subject or any course which involves calculation. While many teachers may tend to

shield few students from failure by holding lower expectations and not recommending higher-level mathematics education. Jackson (2010) in his study observed that some students' dissatisfaction on how some mathematics teachers taught the subject was related to the fact that some difficult topics were not thoroughly covered to involve applications which were to be acquired by students for future use either in daily activities or in their careers. Jackson (2010) study further revealed that teacher learner interaction in classroom should be geared towards achieving a goal; to learn mathematics, teachers should be conscious of their own attitudes towards mathematics and towards his/her students. It is therefore the responsibility of the classroom teacher to reinforce the students accordingly and motivate the students by providing for their individual differences.

2.3.1.2 Teachers' beliefs about mathematics

Schackow (2005) defined teacher beliefs as the subjective ways in which teachers grasp their role (s) in a classroom, their learners, determinants of learning, the teaching environment, and the goals of education. A study has shown that teachers' beliefs about mathematics teaching and learning are mostly formed during their own schooling and are developed because of their own experiences as mathematics students (Thompson, 1992). This implies that, if a teacher perceives mathematics to be a difficult subject, it may affect his or her students since the conceptions about mathematics and how it should be taught maybe deeply rooted in the mind of the student, thereby, developing negative attitude towards the subject by the students.

Schackow (2005) perceived beliefs as primarily rational in nature, but they play an important role in the development of attitudes and emotions about mathematics. The author further explained that even when student- teachers' beliefs appear to be aligned with the education programme they are enrolled for; their teaching practices might not reflect it. The authors deduced that mathematics teachers' beliefs ominously influence how they interpret and implement mathematics curricula and how meaningfully it affects their learners' beliefs and attitudes. These beliefs, held by mathematics teachers link to pedagogy, is obvious because teachers will teach mathematics to students based on the way the teachers will view mathematics as a subject.

2.3.1.3 Pedagogical content knowledge teachers have in teaching mathematics to students with visual impairments

Mathematics content present to students in details encourage the students and same time may influence a change of negative attitude of the students as they got enticed to the presentation given. According to the National Council of Teachers of mathematics (2000) in United States and Canada, teachers who had mastery of content always give details in their lesson and link the topic to other topics; and most essentially, they are able to inspire students by creating good environment for learning. This implies that, in the classroom of students with visual impairments, the teacher plays a critical roles in classroom methodology since he or she has to create the learning environments, specify the nature of learning activities, and decide on the suitable learning resource for better delivery of lesson to the students. In addition, a teacher who has knowledge in mathematics content may deliver lessons to the understanding of the students who are at different cognitive levels and through this, the interest of the students will be created making students to appreciate the content

been presenting to them and as a result of that it may cause the reduction of the work load and at the same time it may promote the attitude of teachers and students with visual impairments, since the content shall be controllable which may have influence on the students with visual impairments performance in mathematics. One of the difficulties that arise for teachers' methodology is teachers' inadequate presentation and this inadequate presentation maybe influence by unsuitability of learning resources, topic sequencing and language levels (Nyongesa, 2004).

In a study of Wanyonyi (2010) an assessment of factors affecting students' performance in mathematics at K.C.S.E. level in secondary schools in Kakamega County, Kenya, he stated that the list of opportunities does not guarantee good methodology rather it is the context in which these activities take place, the importance attached to it and the relationship between them that are the real determine factors. Wanyonyi (2010) further explained that the use of resources is critical in ensuring that learners develop an appreciation and enjoyment of mathematics through a variety of appropriate practical activities because the use of resources and the resulting activities enhance students' understanding of mathematical concepts. Hence, it is significant for the teacher to recognize well beforehand the resources needed for a particular lesson and develop a clear understanding of the role the teaching/learning resources will play in the lesson. Most of mathematics teachers have majored in mathematics or mathematics education and others have majored in professions other than mathematics but employed to teach mathematics, this implies that almost half of the mathematics teachers may not have enough mathematics knowledge and skills which affects their teaching methods (Wanyonyi, 2010). Knowledge of the content to be taught is the cornerstone of teaching. Teachers' knowledge of mathematics content is therefore prominent in discussions of how to improve mathematics instruction.

Improving teachers' mathematical content knowledge and their capacity to use it to do the work of teaching is crucial in developing students' interest in studding mathematics.

Teachers' knowledge of mathematics content and pedagogy is critical to the culture of the learning environment (Koehler et al., 2013). It can therefore be explained that knowledge of the content and pedagogy in combination with learners' thinking, allows a teacher to come out with useful mathematics tasks. This means that teachers will feel successful when their students' performance in mathematics is high and it should also be probable that teachers would feel frustrated and unproductive when the students perform badly in mathematics, irrespective of whether or not they come from a historically disadvantaged school situation.

2.3.1.4 Teachers' instructional methods influencing performance in mathematics

Another problem which face the performance of mathematics among students is the methods used by the teacher. Adino (2015) is of the view that there are various views about the nature of mathematics, teachers should therefore have understanding and be creative in whatever methods they use so that they can give stand to the students' participation in class discussions. This could be done by allowing a learner to demonstrate a concept and others to pay attention to what is said, this may help students understand the concept because they will feel that they are involve. Instructional methods used by teachers in the classroom have shown to have a positive impact on their learning (Grouws, 2004). Teachers are therefore to use divergent methods during teaching and learning process to encourage students to participate in mathematics lesson thereby improving their performance. For example, teachers can give instructions in bits and that may help the students understand concept been taught. Mathematics teachers should try and accept divergent views

from learners during teaching and learning and guide them to tell why they arrived at a particular answer. Mereku (2003) found that the general guidelines on the delivery of the curriculum in the syllabus and teachers' guidebooks recommend that teachers should use investigational or activity methods which are directed towards learning tasks, which encourages inquiry, creativity, manipulative and manual skill. The analysis of the transcribed lesson activities indicated that instructions in the teacher's guidebooks follow a common pattern of classrooms disburse. In this common pattern, the teacher initiates a move for a response from students. The instructions in the teachers' guidebooks appear to indicate, though not every clearly, that teachers should make students learn through activity and not by passive reception of what is taught and emphasize understanding rather than rote memorization, but the style of lesson presentation in the guidebooks stress teaching strategies associated mainly with the exposition teaching method.

According to Kenya Institute of Education (KIE) (2006) teachers are advised to use heuristic methods as much as possible to involve the students and keep the students interested in the mathematics subject for effective acquisition of mathematical skills. Teachers who teach mathematics to students with visual impairments should make sure that students with visual impairments have a free hand to use their own approaches. From the findings of Bolaji (2005), students' attitudes towards mathematics can be influenced by teachers' method of teaching mathematics and his personality greatly accounted for the students' positive or negative attitude towards mathematics. Negative attitudes can occur when the teacher teaching instrument mismatch the understanding of the student. Therefore, Goulding (2002) is of the view that teachers' attitudes are said to affect their method of teaching in the classroom.

2.3.1.5 Teachers' knowledge about students with visual impairments and mathematics

According to Johnsen (2001) a teachers should learn that in teaching students with visual impairment the teacher should face the class when speaking, speak clearly in a normal voice, not loudly, slowly or with exaggeration, keep hands away from mouth when speaking, identify yourself by name in case the student does not recognize your voice and indicate verbally when you are entering or leaving the person's presence. Findings from Beth (2015) study on academic impediments students with visual impairments encounter in the college of university, Rwanda revealed that in teaching students with visual impairments, classroom accommodations should be individualized according to the specific needs of the student. However, there are some basic best practices that can guide the development of the most effective adaptations. One thing to always consider is that it is often difficult for students with visual impairments to become as fully independent as they are capable of being. Classroom teacher should therefore encourage independence as often as possible to avoid the trap of learned helplessness among students with visual impairment (Simon, Echeita, Sandoval, & Lopez, 2010).

Encouraging the student with visual impairment to move independently through the classroom, and organize your classroom accordingly is important for the teacher to do (Beth, 2015). Hence materials such as desks, and other objects in the classroom should be maintained in consistent locations in mathematics class. Beth (2015) advice that teachers should ensure that cabinets are fully closed, chairs pushed in, and doors are not left half opened, this will help with safety in navigating the classroom, this will make the mathematics class becomes attractive for the students and may improve the students interest to learn mathematics which will lead to

improvement of their performance in the subject. Baraka (2013) said that students with visual impairments advocate for assistance is also part of becoming independent for learning. It should be noted that even with accommodations, not all instructional tasks will be immediately possible for a student with visual impairment, and hence instructions should be design so that students have the most opportunity to performance or act independently.

Understanding the nature of the vision loss and the educational implications of students with visual impairments in the classroom as a teacher is very important. For instant, two learners with visual impairment may be assessed as having the same visual acuity but they may each learn and function in very different ways. Also, vision may be temporarily influenced factors such as fatigue, light glare, or inappropriate lighting and as a teacher having knowledge about students with visual impairment is very important so that you will not generalized students visual functioning as same. Teachers who are not special educators may use "trial" and "error" method to find out the best way of teaching mathematics to their students who are visually impaired. According to Maguvhe (2015), teachers who are not specialists cannot effectively articulate subject matter to students who are total and partially. Sahin and Yorek (2009) established similar findings in Turkey, affirming that teachers are unable to impart their knowledge of methods, with the result that not all students are able to participate optimally. However, if teachers try, the blind and partially sighted learners can benefit from mathematics and science education (Maguvhe, 2015). Students with visual impairments encounter also with lack of textbooks and study material and limited braille notation for learning mathematics and the effort of teacher who have knowledge about the students with visual impairments can help students with visual impairments to benefit from mathematics. The blind and partially sighted have equal

competencies than the typically sighted, given accessible media for learning (Sahin and Yorek, 2009).

On the other side, students with visual impairment do have problems with calculations, they already know all basic mathematical operations, however, scale of mathematical knowledge increases here very sharp in all fields: algebra, analysis, and geometry, hence, they will have to overcome a lot of other new challenges, especially with braille notation of all new symbols (Kohanová, 2003). Therefore, the major part of student with visual impairment creates their own particular mathematical language that is adapted to their conditions and requirements. This forms new problems, because these languages do not have to be comprehensible for students with visual impairment to communicate with. The integration of students with visual impairment among sighted ones in the common schools causes that in these specific conditions we find different or new relations in the classroom (Kohanová, 2003). One must distinguish between communication between teacher and sighted students at the lesson and between teacher and non-sighted student, in addition, between non- sighted and sighted students.

In addition, mathematics requires exactness, definiteness, totality, and comprehensibility of presentation. It is very arduous only by oral communication (e.g. when modifying expression or by geometrical construction) and so it is supported by graphical way - text or picture (Kohanová, 2003). This connection is typical for mathematics; because of insufficient style of expression some students rather prefer notation or picture. If we are talking about graphical communication in the frame of communication between teacher and non-sighted student, we mean communication supported by, for example relief's picture, typographic images and plane or space models (construction kit, cubes, skewers, paper). The other case is communication

supported by notebook; the non-sighted student takes notes or computes in electronic form, mainly linearized and they are also useful for student with visual impairment, especially by calculations, it has no sense to urge them to act calculations that are often just very tedious and mechanical (Kohanová, 2003). That is why CAL Systems are helpful because if the commands we put into command-line are linear, it means they are fully textual and therefore suitable for student with visual impairment. The other advantage is that student who are screen-reader does not have any problem to read linear text on the screen (Kohanová, 2003). Thus, student with visual impairment who study computer science use CAL Systems, for example, for calculation during algebra seminars and it is also useful tool for calculations with matrixes, which are time consuming and quite complicated (Kohanová, 2003).

The necessity condition for teachers to teach mathematics is not only to know mathematics but also to be able to understanding the basic contents, concepts and the associated skills so that they can teach students with visual impairment to understand (UNESCO, 1984). UNESCO (1984), further explain that teachers must know what it means to do mathematics to make students achieve good performance, teachers must consider student's perceptions and the ideas the student brings into the classroom. It is therefore important that before concepts will be introduced teachers should find what their students already know about the concepts.

2.3.1.6 Teacher qualification

Professional qualifications are important in education. According to Kaur, Garg, Singla, and Agrawal (2004) teachers' qualification is significant and can be used to predict students' performance in mathematics. The professional skill of the teacher 'establishes a productive classroom atmosphere from the start by means of good organization and carefully planned teaching structures' (Farrant, 1999). Farrant

added that professional competence, frequently transforms into high quality of teaching with the expectation that this would influence the learning of students. Teacher professionalism should be exhibited in skills like giving prompt feedback, questioning, dealing with students' problems effectively and creating specific kinds of climate settings for different lessons, making sure that pupils understood and coped with the amount of knowledge given to them. A teacher who does not have both academic and professional teacher qualification in mathematics would undoubtedly have a negative influence on the teaching and learning of the subjects whiles a teacher who is academically and professionally qualified, but works under unfavourable working environment would be less dedicated to his work and thus be less productive than a teacher who is unqualified but works under favourable environment. Teachers' qualification are vital in determining the students' performance.

Umar-ud-Din (2010) is of the view that knowledge about the subject to be taught definitely influence the teachers teaching attitude and finally the performance of the students. Therefore when a specially trained teacher teaches the students with visual impairments; the performance of the students will be good since in the course of education the teacher is well-thought-out the most crucial element and also there is a direct connection between the qualification of the teacher and the performance of the students as well other factors that may have influence on the learner. Mwangi (2014), observed in his study that teachers' qualities, attitudes, and qualifications are very significant in performance of mathematics and these qualities will lead to good performance and well adapted learning styles. The teachers of students with Visual impairments are encouraged to possess qualities that will enable the teachers to teach mathematics to their students in the simplest and most effective ways (Mwangi, 2014).

In addition, in the study of Mwangi (2014), the teacher of mathematics who teaches mathematics to students with visual impairment need to have proper know how on how to manipulate various concepts regarding their professionalism. Having a teacher who teaches for understanding, makes lessons enjoyable (Mazana, et al., 2019). This implies that teachers' qualification in teaching mathematics to students with visual impairments is very important and should be an objective of study. In the study of Maguvhe (2015) on teaching science and mathematics to students with visual impairments: Reflections of a visually impaired technician, it was revealed that teachers were not well trained to teach the blind and partially sighted learners, and lacked the necessary innovation where resources for the teaching of science and mathematics were limited. The findings of Maguvhe are similar to with Sahin and Yorek (2009) that many teachers who teaches students with visual impairments do not have direct experience in teaching blind and partially sighted learners. As a result of that they do not know what to do to improve the learning conditions of their students. Maguvhe's finding further explained that one cannot tell whether today teachers who teach mathematics to students with visual impairments are prepared or not, because if they have prepared, why are they reluctant to teach mathematics and science? Why do they put the blame always on lack of resources? Why do they put the blame on lack of training and workshops? Why do they put the blame on blind and partially sighted learners who cannot understand graphs, maps, tables and so on? Teaches who are well trained and have prepared will not always play blame games. A better trained and experienced teacher produces high academic performance than the untrained teacher (Bell, 1998). Adequate qualification of the teacher instills self confidence in the teacher and serves as an inspiration to students while teachers without proper academic and professional qualifications fail to do justice to the students (Shiundu & Omulando, 1992).

2.3.2 Student-related factors

2.3.2.1 Students' attitudes towards mathematics

Attitude is pronounced factor that influence the performance of students in mathematics which as a concept is concerned with an individual's way of thinking, acting and behaving (Olatunde, 2009). However, it has implications for the student, with which the student relates. Students must therefore understand that attitudes are formed as a result of some kind of learning experiences and may also be learned simply by following the opinion of teachers, parents and learning situation.

Attitude is either positive or negative depending on whether a person likes or dislikes something or someone (Njue, 2005). Therefore, attitude towards mathematics can be define as liking or disliking of the subject (Kibrislouglu, 2015). The question here is that what would be the likely sort of such attitudes among students with visual impairment towards mathematics as a factor influencing their performance in mathematics in basic school level? Students' attitudes towards mathematics influences the efforts they put in understanding and practicing mathematical concepts and skills (Enu, et al., 2015). Finding from a study conduct by Bolaji (2005) point out that students may have positive and negative attitude towards mathematics and this attitude normally cause by the teachers' method of teaching mathematics to the student and his personality greatly accounted for the students' positive attitude towards mathematics but according to Wasiche (2006) poor performance in mathematics to teachers reinforcing negative attitudes towards the subject among the students. The teachers may knowingly or unknowingly depict high achievers as the probable achievers in mathematics examinations but low-attainers to be the automatic failures in examinations and they show it openly. This may create a negative attitude towards the subject among the low achievers, who may not learn the subject

effectively. Teachers' influence on students' attitudes and students' positive attitudes are very important factors needed to enhance students learning of any subject and more specifically mathematics. Students' attitudes to learning is based on their understanding of the concepts, these concepts tend to develop positive and negative attitude towards learning. The negative side of the students' attitude may cause low performance among the students in mathematics, preventing them from obtaining necessary result from further study.

Jackson (2010) explained that continual low academic achievement might lead to negative attitudes towards the subject which in turn may influence how a student will learn the subject mathematics in the subsequent years of education. The challenge though to this assertion is whether the repeated low grades achieved earlier influence attitudes formation or do attitudes formed earlier influence how a student learns the subject mathematics and consequently how the student will perform in mathematics. Negative attitudes towards mathematics learning may develop due to repeated low achievement in mathematics examination or test. Equally excess work load or poor teachers' teaching method and teachers' failure to attend to individual difference may lead a students to experience negative feelings towards learning of mathematics may cause the student to develop unfavorable attitudes to the subject (Jackson, 2010).

In the issue of students' attitudes towards mathematics, a study by Costello (1991), indicates that students formed different attitudes towards mathematics because some described mathematics as hard or difficult. This attitudes towards mathematics by students influence how they learn mathematics and can lead one to learn less mathematics and consequently achieve little (Jackson, 2010). Therefore, students' attitudes play a major role in their effort to learn mathematics and it could be formed positively or negatively towards learning of mathematics of which significantly can

affect their ability to learn and understand subject. Similarly, since attitude has influence on how students learn mathematics, it may really affect how they perceive their own mathematical competence. For example, students may see mathematics subject as an unconceivable set of abstract procedures and methods to follow, not being conscious that there are reasons underlying these methods. This could cause students to be frustrated from pursuing studies in mathematic because of the lack of understanding of the mathematics subject.

Students with visual impairments attitude towards mathematics may contribute to significant difference in mathematics performance. Mazana, et al. (2019) conducted a study on investigating students' attitude towards learning mathematics. Quantitative and qualitative data were collected from 419 primary school students, 318 secondary school students, and 132 College students from 17 schools and 6 colleges in mainland Tanzania using a survey. The collected data were analysed using percentages, means, standard deviations, ANOVA, correlation, regression, and thematic analysis. It was found that attitude towards mathematics significantly predicted students' performance. It was again, found that initially, students exhibit a positive attitude towards mathematics, but their attitude becomes less positive as the students move forward to higher levels of education. The result of the study further show that some students learned mathematics because it was relevant to what they aspired to be and some of the students opined that, mathematics was not important for their careers.

This implies that when students with visual impairment have a belief that mathematics is not useful in their lives, they may show negative attitude towards the subject by avoiding putting in effort to be successful in the subject while students who study mathematics subject with positive beliefs are more likely to achieve high learning gains. This further implies that with interest and personal effort in learning

mathematics by the students with visual impairments themselves, they can perform well in mathematics since they may show positive attitude towards the mathematics subject. This would suggest that teachers should therefore open up for some characteristics that will help students develop a positive attitude towards the subject Mazana, et al. (2019), since students with visual impairment attitudes towards mathematics have an impact on the mathematics subject and also future study of the students which in turns may reflects in their career choices.

With regards to career development, Mazana, et al. (2019) findings revealed that some students were willing to study mathematics in advanced levels because they perceived mathematical skills as essential when it is linked with their career aspirations like science, engineering, business, and the like. Students with visual impairments must therefore realize the importance of mathematics as it is used in many career areas like life sciences, social sciences, technical fields and medicine. This account that if students with visual impairment do not have a good knowledge of mathematics, the competition and the opportunities in the career world will become a serious problem for them because they will exclude themselves from many career routes that need mathematics. Another aspect of importance of students with visual impairments' positive attitudes towards mathematics is that, the more they show positive attitudes towards the subject, the more they succeed in mathematics, the more students succeed in mathematics, the more likely they are to believe that they can succeed and the more the students with visual impairment believe they can succeed the more engaged they will become with learning mathematics subject.

However, most students of which students with visual impairment are of no exception fail in mathematics because of their teachers' perception about them. Mazana, et al. (2019) stated in their study that "sometime the teacher who teaches

mathematics gives up teaching student because they believe students whom they teach can fail (p. 221)". This attitude teachers' exhibit may discourage and drive away students especially the low ability ones who need some encouragement and support from teachers. This implies that low ability students may felt ignored and unsupported as a result of their teachers' negative attitude they show towards them. This can cause the students to show negative attitude towards the subject. Mokgaetsi (2009) stated that, negative side of the students' attitudes may cause low performance among the students in mathematics, preventing them from obtaining necessary result from further study. Hence student with visual impairment attitude towards mathematics achievement must be a concern of teachers and the students themselves.

2.3.2.2 Peer support

Peer support is part of the teaching process that involves learners teaching other learners (Evans, Flower, & Holton, 2001). Oloo et al. (2016) is of the view that peer support is one of the factors that can influence students' performance in mathematics highly effective in raising the standard of understanding of mathematics concepts.

To engage students and promote academic success among students with visual impairment, peer tutoring (support) can serve as effective strategy to promote the performance of students with visual impairments in mathematics. Lazarus (2014) explained that peer tutoring improves mathematics performance for students at risk or experiencing mathematics disabilities. According to a study conducted by Vassay (2010) on peer teaching in college mathematics, findings shows that peer tutoring greatly affects the intellectual and moral values of the students such as the ability to express their ideas, mastery of different concepts, time management, and sense of

responsibility, sharing, self-discipline, self-reliance, self-confidence, resourcefulness, cooperation and obedience.

Findings of Jackson (2010) in a study of attitude towards learning and performance in mathematics among students in selected secondary schools in Bureti district, Kenya revealed that students who were encourage by their friend and relatives to study mathematics, the encouragement trend has influenced their performance in the subject. Students had little interest in mathematics as a subject and there were no mathematics reference books and textbooks and these were major reasons which made students loose interest in the subject (Jackson, 2010).

2.3.3 School-related factors

The systems of a school lead to higher or low future incomes for students. A positive effect of school inputs on individual teaching and learning processes may have influence on student performance. The reason been that some studies have find no evidence or have concluded that small classes do not improve student achievement (Hanushek, 2003; Wößmann & West, 2006), other researches such as Krueger and Whitmore (2001), and Angrist and Lavy, (1999) found indications of a positive impact, and this makes its uncertain whether class size has effect on students' performance.

2.3.3.1 Importance of class-size to students with visual impairment performance

Hanushek and Woessmann (2010) are of the view that class size is very importance in terms of student academic performance because when class size reduces student achievement or performance rises. This implies that students with visual impairment performance in mathematics may improve when class-size is reduced. Leah (2011) is of the view that though class size reduction is essential, but it is very expensive, and little or no consideration is given to alternative and more

productive uses of those resources. Leah added that most people in the educational society advocating smaller classes for better achievement because the largest contribution to the quality of learning is determined by the environment in the classroom. Pupil-teacher ratio is important in the classroom environment, sometimes the ability to deal with disruptive students or disruptive issues in the classroom because of the large class-size puts the teacher in the position of having an almost unbearable situation in which to teach and the students to learn becomes difficult (Leah, 2011). Biggs (2003), agreed that one factor governing student learning is classroom management, what the teacher does in the classroom to structure and organize a learning environment is very important because it increases students' performance and the teacher can manage his/ her class base on the size of the class.

2.3.3.2 Class size effect on students' performance

The effects of class size on students' performance has been studied in many areas and the outcomes of this study show diverse effects of class size on students' performance. The theory of effects of class size has been summarized on learning which has been focused on how instructors and students behave differently in large and small classes (McKeachie, 1990). It is recorded that in the large class, discussion time becomes fragmented among students and instructors may rely on passive lecturing, assign less written homework or fewer problem sets, and may not require written papers. To add, it may be difficult to teachers to know each student personally and modify or adapt pedagogy to individual student needs in a large class. McKeachie's (1990) survey of the education literature, however, suggests that learning is not affected much by class size largely because instructors do not adjust their teaching methods to class size. Kibui (1995), in a study that influence the examination performance of public and private primary schools in Nairobi, found that

if students are crowded in their sitting positions because of the size of the classroom; they find it difficult to write in their books, teachers are also unable to move round the crowded class. This means that the teachers are not able to teach with ease all students in order to check their individuals work as they sit working in their places and this can affect the performance of students.

In a study by Maria and Vincenzo (2013) on class size effect on students achievement: heterogeneity across abilities and fields, it was revealed that larger classes has a significant and sizeable negative effect on student performance in mathematics, importantly finding was revealed that the negative effect of class size is significantly larger for low skilled students. According to Maria and Vincenzo (2013), on the other hand, class size effects do not appear to be relevant for student achievement in language skill but it is relevant to arrange mathematics lesson in classes of small size, since a reduction in class size appear to be mostly effective for student performance in this type of subject. In addition, the organization of teaching classes should take into account student abilities: the benefits of smaller classes is much more relevant for low ability students (Maria & Vincenzo, 2013). Large classes may be viewed as an obstacle to the performance of students with visual impairments in an inclusive classroom (Agran, Alper & Wehmeyer, 2002). Stoler (1992) and Van (2001) discovered that, larger classes place additional demands on the regular educator, while reinforcing concern that all students may not receive proper time or attention. From the empirical analyses of Krueger (1999), Nye, Hedges, and Konstantopoulos (1999), and Krueger and Whitmore (2001), it emerged that smaller classes increase student achievement, even after controlling for school fixed effects and teacher characteristics.

Besides, Krueger and Whitmore (2001) assert that, large class size affect educational materials because there may not be enough for the number of students in a particular class. This may affect teachers' willingness to teach mathematics to students with visual impairment.

2.3.3.3 Influence of mathematics curriculum on students with visual impairments performance in mathematics

Curriculum is the means and materials with which students interact for the purpose of achieving identified educational outcomes (Edward, Ebert, & Bentley, 2013). Curriculum has some deficiencies which do not embrace students with disabilities including students with visual impairments (Acheampong, 2017). Meanwhile, it was emerged from the study of Maguvhe (2015) that the mathematics and science curricula are accessible to the blind and partially sighted learners. Maguvhe's findings shows that learners who are blind and partially sighted have the same mental capacity to comprehend mathematics and science. Maguvhe believe that the curriculum is accessible because there is a lot of technology for braille users today, which includes mathematics and science kits that we understand. The author added that it is the teachers themselves who make the mathematics curriculum inaccessible because they do not believe in the students with visual impairments. This makes the teachers not to go all out giving their best when teaching. Having knowledge of how to address the needs of the learner is important, if one has mere knowledge of mathematics and lack the knowledge of how to address the needs of the learner is not enough. Therefore, it is obvious that students with visual impairments can equally learn mathematics as compare to their peers but the challenge may be that teachers who teach mathematics to the students with visual impairments are not well equipped to teach mathematics to the students.

The mathematics curriculum is achievable, but teachers lack practical knowledge of possibilities of learners with visual impairment in mathematics and science- hence their doubts about the capacity of their learners in the mathematics subjects (Maguvhe, 2015). Kumar, Ramasamy and Stefanich (2001) are of the view that the blind and partially sighted learners have the same mental capacity to comprehend mathematics subject. Blind and partially sighted students need to be properly accommodate to in other to perform as well as their sighted counterparts in mathematics, diversities of technologies are now available to allow for the participation of blind and partially sighted learners in mathematics and science education (Sahin & Yorek, 2009).

National Center for Blind Youth in Science (2010), added that Dr. Abraham Nemeth in the late 1940's, students with visual impairments read mathematical text independently because there is a software tutorial for learning the Nemeth Code of braille Mathematics. This software tutorial can help teachers and students who are visually impaired to solve mathematics word problems (Beal & Shaw, 2008). Research studied by Agrawal (2004) which was carried out in the same field of special education, demonstrated that students who are blind can perform well in mathematics when they are taught in an appropriate manner. According to the participant, the main problem is that teachers are not well equipped to teach mathematics and science to blind and partially sighted learners. The participant is of the view that teachers lack practical knowledge of possibilities of students with visual impairment and in mathematics and science. Hence their doubts about the capacity of their learners in those subjects. They also lack the requisite knowledge of blindness and visual impairment to enable them to provide for the needs of their learners in mathematics and science.

Curriculum has a major effect on students' achievement and it also plays a crucial role in providing opportunities for students' learning (Schmidt, McKnight, Houang, Wang, Wiley, Cogan, & Wolfe, 2001). The curriculum influence on performance is based on the pedagogical techniques of achieving meaningful learning of the contents and also the conceptual and procedural understanding. Jackson (2010), new curriculum implementation and syllabus re-arrangement become a challenge to teachers to acquaint themselves and this impacts negatively on how students learn mathematics while in class. As a result of that, an attitude towards mathematics can be created both by the learner and the teacher when new concept is introduce in the syllabus and teachers attitude may reinforce the attitude formed by the learner towards the new concept.

However, Mazana et al. (2019) mentioned that the mathematics curriculum is very long, hence, teachers fail to complete the syllabus. As a result, teachers moved very fast. This made it hard for students to follow the instructions. It is clear therefore that uncompleted mathematics curriculum can have direct effect on students' performance in mathematics because if it happens the uncovered content appears in the examination, the students will not be able to attempt, hence poor grades.

2.3.3.4 Availability of teachers as human resources and other teaching and learning resources in school

The availability of teaching and learning resources go a long way to improve quality teaching which enhances academic performance (Enu et al., 2015). According to Ankomah (1998), cited in Enu, et al. (2015), effective teaching and learning greatly lied on the competences of its human resources as well as material resources which is needed for the impartation of knowledge. The use of media as teaching resource is essential in the teaching of mathematics because: It increases learners' motivation by

creating a conducive atmosphere which is stimulating, interesting and intellectually rewarding. Motivation increases because of the learning resources' concreteness and appeal. The level of motivation will depend on how the teacher organizes the class for the utilization of the resource. It leads to sharing of ideas, thought, feelings and knowledge.

Study conducted by Maltese (2006) on teaching mathematics to a blind students, the study revealed that lack of resources lead teachers and the learners to automatically skip certain mathematical tasks stated in the syllabus such as measuring angles using a protractor, measuring of objects using a ruler and other similar tasks. Students with visual impairments learn in much the same way as the sighted. However, some modifications are taken into consideration. Maltese (2006) study further revealed that handouts and examination papers were printed using a large font or enlargements from A4 to A3 photocopying were applied. However, in certain cases adjusting the format of the print to bold is enough. This was preferred to the former modification so that students feel less different than the other colleagues. In the case of the totally blind, during exams, an amanuensis is provided to assist the student in reading and writing. During lessons at school, not all the students with visual impairment are provided with a facilitator to help them as they can cope on their own. Most of them are placed in front row so that they can see the board clearly (Maltese, 2006).

Jackson (2010) explained in this study that sufficient learning resources for mathematics and equal access to these resources by all students are important. They may include books, teaching aids, talking calculators, computers, and braille materials. The appropriate utility of these resources must be the concern of the teacher. The teacher concern needs to ensure proper usefulness of the equipment.

Where there is shortage, a well-set program should be made to ensure all students including students with visual impairment access mathematics practical rooms and any other facility meant to promote mathematics learning.

Materials should teach students to learn, that there should be resource books for ideas and activities for instruction/learning, and that they should give teachers rationales for what they do (Beth, 2015). Idol (2006) in contrast, argues that material may be suitable for students' needs and make it possible for students to review and prepare their lessons that text books are efficient in terms of time and money, and that text books can and should allow for adaptation and improvisation. Materials include textbooks, video tapes, computer software and visual aids influence the content and the procedures for teaching (Beth, 2015). Maguvhe (2015) is of the view that lack of resources, unprepared teachers, experiments graphs, maps and tables are some of the setbacks students with visual impairments encounter when doing or want to do mathematics and science. However, this should not be an excuse not to teach them.

Teachers of students with visual impairments, primary responsibilities are to adapt and adjust the general education curriculum and related material such as replacing regular print with braille or large print and to provide direct instruction in each of the areas of the extended core curriculum (Spungin & Ferrell, 2010). Bowen and Ferrell were of the view that students with no vision or limited vision need multiple encounters to accurately interpret sensory information; these encounters must be paired with concrete experiences to build concepts and environmental meaning, if accessibility to learning materials is the only problem the visual impairment presents, then educating students with visual impairment can be solved by adaptation of the existing core curriculum (Hatlen, 1996).

However, visual impairment is an umbrella term which talks about low vision and total blindness. Students with visual impairment are therefore a heterogeneous group of individuals who have complex educational needs that are compounded by multiple variables such as the age of onset, the severity of the vision loss, and their overall functioning level. The common characteristic between the students with visual impairment is that they are all students with visual impairment, that is, they have less-than-fully functional visual systems that can interfere with expected progress in general education programs unless they receive specialized instruction (Huebner, Drane, & Valois, 2000). If schools do not provide sufficient number of resources, learners, especially students with visual impairment, are likely to develop low interest in mathematics because students with visual impairments like manipulative teaching modes hence in the mixed classroom or inclusive classroom teacher should make sure they use learning materials. In addition, inclusive schools therefore need to have well-equipped and well organized classrooms so that students have enough books and other resources for better improvement in their performance in mathematics as a subject.

2.3.3.5 Environmental noise

There has been a research on the effects of noise on learners learning and performance at schools. A study by Shield and Dockrell (2003) has examined the effects of noise on children's cognitive processing in a range of tasks and on their academic performance at school. In addition to the examination of the effects of noise on children's performance, a limited number of surveys have investigated the annoyance experienced by learners in relation to their noise exposure at school (Shield & Dockrell, 2003). The authors explained that it is generally accepted that noise has a detrimental effect upon learning. The authors further made emphasis on performance factors which need to be considered when investigating the effects of

environmental noise. These could include literacy, attention, mathematics, and memory. Tasks that involve languages such as reading and those that have high cognitive processing demands attention. Environmental noise may affect students with visual impairment performance in mathematics, as many other factors, unreported. Shield and Dockrell (2003) said in their study at London schools that there was a high correlation between a school's external noise level and the percentage of children having free school meals at the school. This means that students schooling in noisy areas or environment where they are exposure to environmental noise may affect their academic performance. In the study of Shield and Dockrell (2003) it was found out that in 1970's Crook and Langdon in their study found that in schools around Heathrow aircraft noise had impact on teaching by interfering with speech and causing changes in teachers' behaviour in the classroom.

In generally it can be said that noise has a detrimental effect upon the learning and attainments of students with visual impairments in school. In the study of Mazana, et al. (2019), it was indicated that some students failed to understand the subject matter because others were talking as classes were in progress. The noises hindered students' understanding of mathematics and consequently affected their performance. This implies that the atmosphere in the classroom was not good, hence teachers should enhance classroom management skills to get the attention of the students in the classroom.

2.4 Strategies that could be adopted to Improve Students with Visual Impairments' Performance in Mathematics

Students learning mathematics do so with assistance from their teachers. Teachers should therefore provide guidance and counseling to student and motivate

them by providing for their individual differences (Jackson, 2010). Moreover, it is also suggested for the teachers to learn to formulate their way of teaching especially if their schools do not have available facilities to support their teaching activity. They may learn to develop their profession and innovativeness in teaching in order to maximize the use of available resources of the school to improve students' performance in mathematics subject (Isack, 2015).

2.4.1 Role of the society and parents

Parents are also given a major role to play as a strategy of improving their children with visual impairments performance in mathematics because they actually participate in decision-making that concerns making changes. Parents are normally very observant of their children's performance that school often tells. Notwithstanding, parents and public should desist from viewing mathematics as a subject as if it were unknown territory where one is expected to venture without tools to guide him/her. Mathematics should be viewed by students with visual impairments and the public with a more positive attitude. Since the students with visual impairments are first in the society before they are in school, they unconsciously form attitudes whether positive or negative towards mathematics and towards anyone who teaches mathematics (Costello, 1991).

Children learn mathematics concept before they go to school because Claessens and Engle (2013) are of the view that children show mathematics knowledge in home even before school. Therefore, if effort is not made to counter unfavourable attitudes towards mathematics being formed by students with visual impairment as they enter the school the attitudes may overshadow their interest in mathematics which may influence their performance. Parents should deliberately attempt to treat their children equally, make unbiased comments regarding learning of

mathematics and avail equal opportunities to their children to pursue mathematics (Costello, 1991). This is with an effort to negate the unfavourable attitudes from being formed, especially by the students with visual impairment. Parents who achieved well in education and other role models in the society should make deliberate effort to popularize the subject and go out of their way to convince the young ones about the importance of the subject (Costello, 1991). Notwithstanding, some students, especially boys know that mathematics is a very important subject especially in choosing career and application later in life and yet fail to develop interest and learn the subject while in school (Jackson, 2010).

2.4.2 Use of peer tutor

A peer tutor is a student who helps another student(s) during teaching (Block, 2007). Block added that peer tutor is important because it is done to reduce the workload and pressure on teachers and for children with special needs and their non-disabled peers to effectively interact in the classroom. Peer tutoring in other hands can be explain as a teaching strategy where skillful students teach other students in the same grade level with the guidance of a teacher (Doganay, 2007). Peer tutoring is important because it helps students to take part actively in tasks, and promote their level of involvement (Nurmi, Hirvensalo & Klemola, 2013).

For peer tutors to have a positive effect on the performance of students with visual impairments in the mathematics classroom there may be the need for training and preparing the peer tutor. Yang and Rusli (2012) stated that peer training may be necessary for peer intervention when teachers want to use them for teaching. They added that, in the training peers are taught different strategies that will help their classmates with disabilities increase interactions or responses to questions being asked. Zwald (2008) is of the view that the use of trained peer tutors is one of the

instructional strategies many teachers use for including students with visual impairments into the regular classroom.

Evans et al. (2001) stated that peer tutoring is a structured way of involving students in each other's academic and social development. As a learning experience, it allows students to interact and to develop personal skills of exposition while increasing their knowledge of a specific topic. Students who support their peers may be high-ability learners or learners in higher grades and may equally benefit learners motivationally from being in groups which provide peer encouragement and support. As a result, their performance can be improved. Teachers should understand the nature of peer relationships among the students since peers can encourage one another to view mathematics positively or negatively. Scruggs, Mastropieri and DcDuffie (2007) are of the view that there is a benefit in co-teaching which include communication among students and teachers to enhance teaching.

2.4.3 Verbal description of instructions

When teaching or demonstrating activities to students with visual impairments descriptive verbal instructions may be used (Letcher, 2016). Whatever needs to be said for students to understand instruction, must be said the exact way it is being performed.

Again, in teaching the students who with visual impairment, charts, diagrams, graphs and other information being presented in a visual format must be explained and described verbally (Miner, Nieman, Swanson, Woods, & Carpenter, 2001). The use of verbal descriptions influences childrens' abilities to deal with their emotions (Luo, 2000). Lou further stated that, students must be reinforced by their teachers during teaching through praise. When these are done, students with visual impairment will be able to express their feelings in words. Nevertheless, Ponchilli (n.d.), debate

that, demonstrations in teaching are better instructional choices than verbal instructions. Students with visual impairments must always be provided with detailed verbal descriptions of cues when they are in a very complex environment (Garaj, Jirawimut, Ptasinski, Cecelja & Balachandran, 2003). A study was conducted by Carpenter and Nangle (2002) on effects of brief verbal instructions on aggression in pre-school pupils. The researchers used 19 pre-school children as the subjects, whom they observed over time during the period of the study. The findings suggested that, the use of verbal instructions help teachers to minimize aggressive behaviours among children in pre-school. The differences between the study conducted by Carpenter and Nangle and the current study was the use of pre-school children as the participants while the current study focused on students in a basic school. However, similarity on the other hand is the use of verbal instruction as a strategy for effective participation of student in classroom activities.

2.4.4 Resource teachers' support

Another strategy when put in place can improve the student with visual impairment performance in mathematics is resource teacher services or support. This support objective is to help students with visual impairments in regular classrooms to achieve the best in learning. Resource teachers are specialists and consultant who are trained to assist teachers in methods of assessment, instructions, materials preparation and equipment building (Baine, 2001). This means that the regular teachers and the resource teachers work in hand in hand. Most of the mainstream schools in Ghana, specialist teachers of students with visual impairment provide resource room support. In the classroom, most the teaching is done by the regular classroom teacher while exercises for students who are visually impaired are transcribed by the resource teacher for the regular teacher to grade. It can therefore be deduced from Baine's (2001) study that, resource teachers are important in improving mathematics

performance of students with visual impairment because resource teachers provide in-service training for the other teachers on how to manage the children with visual impairment in learning and also help children with visual impairments to adjust in the general education which may help them benefit from their education.

2.4.5 Students positive attitude towards homework

Homework is one of the instructional tools used by teachers to determine a learner's academic engagement. Parents therefore should make sure that they advised their children to do their homework in the house or hostels and teachers make sure they give homework to their students. According to Grouws (2001), the purpose of homework includes the following:

- Developing skills
- Increasing understanding
- Demonstrating application
- Developing connection

Pezdek, Berry, and Renno (2002) showed that homework could have both positive and negative effects. Mullis (1990) found that in some states in the United States of America, learners who reported doing homework had low achievement in mathematics as a subject. Cooper (1994) also reported significant negative effects of homework, namely loss of interest on academic material, pressure to compete and perform well; parental interference, confusion regarding instructional techniques, copying homework from other learners and physical and emotional fatigue. Although there positive and negative effect of homework however, research has shown, that the positive effects of homework outweighed the negative effects.

2.4.6 Teacher in-service training

Teacher in-service training is designed to equip prospective teachers with the knowledge, attitudes, behaviors and skills they require to perform their tasks effectively in the classroom, the school and wider community, although, ideally, it should be conceived of and organized as a seamless continuum (Adino, 2015). Adino further explained that teacher in-service training are initial teacher training/education such as pre-service course before entering the classroom as a fully responsible teacher; induction (the process of providing training and support during the first few years of teaching as the first year in a particular school) teacher development or continuing professional development (CPD) an in-service process for practicing teachers.

In the study of Maguvhe (2015) on teaching science and mathematics to students with visual impairments: The study revealed that mathematics and science teachers who teach mathematics to students with visual impairments need to attend regular staff development workshops covering selected topics in mathematics, science and accommodation suitable for the blind and partially sighted learners. Maguvhe further said teachers who teach mathematics to students with visual impairments need to be inspired to attend workshops to enable them keep abreast to curriculum demands, new developments in their subject areas and emerging technologies for accommodating their learners' educational and wellness needs. It also emerged, according to opinions expressed by the participant that teachers have to develop information-gathering skills through actual research and also create networks with other area specialists all over the world (Maguvhe, 2015). Maguvhe gave the following two quotations from his findings:

- Teachers should have workshops for mathematics and science in addition to joining university programmes that will equip them to understand the learners they are teaching.
- Teachers can as well network with colleagues in their area and abroad and exchange ideas on how to teach learners who are blind mathematics. In another study by Mwangi (2014) on pedagogical challenges facing mathematics teachers of learners with visual impairment at Thika Primary School for the Blind, Kiambu County, it was revealed that 12 (nearly 75% of teachers who taught mathematics to students with visual impairments) had neither attended any refresher course nor workshop and seminar concerning the teaching of mathematics to learners with visual impairment. Mwangi (2014) findings also show that, when the following measures are put in place as in-service training to teachers, it will help them in improving students with visual impairments performance in mathematics.
- Creation of extra time and effort for the students to enhance their manipulative skills of mathematical tools.
- Increased attention to students' individual challenges and needs in the acquisition of Mathematics computation skills.
- Intensified use of resource person especially fellow mathematic teachers in teaching of presumed challenging topics like geometry with emphasis on construction of spherical shapes, nets and measurement of cylinders.
- Teachers to continuously sensitize fellow teachers in relating mathematics with other regular subjects during their instruction where possible. For example, science teachers could use addition and subtraction to teach. Social

Studies teachers could use various Mathematic aspects when handling topics involving calculation of time east or west of the Prime meridian.

Kohanová (2010), says that because teachers of most schools are not educated in the handling students with visual impairments, they often have to use the ”trial and error” method to find out the best way of teaching their students who are visually impaired and are integrated among sighted students. Hence teachers who teach student with visual impairment should have series of in-service training in order to be able to teach students with visual impairment mathematics. Teachers who are recruited and posted to teach in schools should be ensuring that such teachers have received adequate training, such as in-serviced, where necessary and proper supervision is done in schools (Jackson, 2010). According to Maguvhe (2015), there must be training programmes at institution for teachers who teaches students who are blind and partially sighted, a hands-on qualification such as a diploma in special education with specialization in visual impairment would do.

2.4.7 Group work

Students have different learning styles and they need to adopt the style that can improve their performance in mathematics. Learning of mathematics cannot be narrow to only learning from teachers or textbooks. Group work is one of the learning strategies that teachers can adopt to improve students with visual impairment performance in mathematics because obviously, it enable the students to work as a team. Lee (2006), states that when people pull together their knowledge, they can outperform the brightest of individuals. This implies that grouping students with visual impairment in the mathematics setting can be substantial and effective.

Researchers at the University of Illinois conducted a study that included 760 college students. They asked these students to crack a code that tested mathematics and logic skills, some worked alone while others worked in small groups. The students who teamed up performed than even the top-scoring single individuals in the school. Therefore, grouping students for mathematics task can produce best results because they build on each other's insights, making it easier to prove the correct answers, as well, students becoming more familiar with their peers. Panitz (2000), the author of Using Cooperative Learning in the Mathematics Classroom, interviewed her students after they had worked in groups, one of her students responded to her question by saying, "Before your class, I disliked math. I was always getting aggravated and scared by it. Working together with those around me in a group was a great help in understanding the material and many ways in which a problem can be tackled and solved" (Panitz, 2000, p.8). The author added that, there are many benefits to cooperative learning, it does not only benefit the students and their learning, but it also benefits the teachers. Group work increased the opportunities for communication and made problem solving a richer experience for students (Williamson, 2006). Students felt isolated and frustrated when they were asked to work by myself but showed confident and felt less frustrated with the material when they were asked work as a group (Williamson, 2006). However, teachers need to be observant not to allow the weaker ones to relax since this will not help achieve the objective of the lesson.

2.4.7 Adaptation of mathematics material

One of the strategies that can improve students with visual impairment performance in mathematics is adaptation of mathematics material. Agesa (2014) pointed out that, students with visual impairments found it very difficult to perceive

the qualities of objects when they are not embossed for touch and manipulation. Therefore, by adapting mathematics equipment, to students with visual impairments will assist teachers to help students with disabilities to be more experienced (Teketel, 2010). Asempa (2013) conducted a study on adaptations for enhancing inclusion of pupils with disabilities in selected schools in Ghana. Ninety teachers were randomly selected for the study, and questionnaire was used to collect the data. The findings in that study showed that though there were adequate instructional materials in the schools, they were not adapted to meet the needs of students with disabilities. Asempa study further revealed that teachers should be provided opportunities for in-service training so they can acquire requisite skills in adapting the national curriculum to enable pupils with disabilities to participate effectively in teaching and learning process. The more children with visual impairments engage in class activities, the more they increase in their daily step counts (Foley, Lieberman, & Wood, 2008).

However, Kentiba (2013) stated that, inadequate materials and equipment affect the participation of students with disabilities. Kelly, Ajuwon, and Wolffe (2015) study revealed that, lack of adapted equipment was one of the challenges adults with visual impairments face in participating in recreation and teaching activities. This means that if the mathematics materials are not well adapted, students with visual impairment may not be able to participate effectively in mathematics lesson. Herold and Dandolo (2009) conducted a study and one of their findings revealed that the pupil with visual impairments sometimes experienced inequitable learning situations, because the teacher used and adapted general inclusion materials for learning that was not favourable to the student. It was recommended that resources needed for including students with visual impairments should be audited systematically and should be accessible learning resource bases. Mathematics material

for teaching students with visual impairments therefore need some modifications for the students to successfully participate. Provision of adaptations to students with disabilities promote equal opportunities and avoid discrimination (Petrie, Power, & Swallow, 2009).

2.4.8 Adaptations of instructions

Most students of visual impairment may enjoy mathematics subject if the instructions are well adapted. Students with visual impairment find it extremely difficult to learn when instruction is not simplified and presented in concrete terms. Faison-Hodge and Porretta (2004) are of the view that, students with disabilities find it difficult to complete tasks given to them due to lack of clarity, but not because they are being to physically perform the activities. The findings from a study conducted by Koeze (2007) in Michigan, also showed that differentiated instructional strategies of choice and interest played a very important role in achievement and student satisfaction in learning.

Winnick (2011) stated that one-on-one instruction are very necessary. Montagnino (2001) also noted that, when students are participating in activities, specific instructions must be given to the students. Ontario Curriculum (2005) argued that before every activity starts, instructors must ensure that students' attentions are gotten before the instructions begins. Hence when teachers are giving instructions in mathematics classes, students with visual impairment are expected to pay attention while he or she speaks to the class. However, some teachers lacked skills and competence in adapting their instruction to meet the needs of students who are blind (Igune, 2009). A study conducted by Alhassan and Abosi (2014) on how teachers adapt instruction to suit pupils with learning disabilities in the regular classroom indicated that, regular teachers have limited to moderate competence in adapting

instruction. Meanwhile, another finding from the same study also showed that adapted instructions were very necessary for the competence domain of students with learning disabilities for their effective inclusion into the regular classroom. Alhassan and Abosi (2014) added that, teachers need to change their classroom practices through the use of adaptive instructional practices for student to be successful in inclusive classroom. However, most teachers find it very difficult to adapt their instruction in inclusive classroom (Hodge, Ammah, Casebolt, Lamaster, & O'Sullivan, 2004).

2.5 Summary and Research Gaps

The variables for the literature review were overview and performance of students with visual impairment in mathematics. The evidence provided by the literature together with the empirical evidence disclosed that students with visual impairment performance in mathematics have been influenced by a lot of factors. It disclosed that teacher-related factors such as teachers' attitudes towards mathematics, teachers' beliefs about mathematics, Pedagogical content knowledge teachers have in teaching mathematics to students with visual impairments, instructional methods influencing performance in mathematics, teachers knowledge about student with visual impairment and teacher qualification have influence on students with visual impairment performance in mathematics. Again, the literature revealed that students attitude and peer support are examples of student-related that have influence on students with visual impairment performance in mathematics. To add to, concerning the factors that have influence on students with visual impairment performance in mathematics it was disclosed that school-related factors such as class size, mathematics curriculum, environmental noise, availability of teachers as human resources and other teaching and learning resources in school are factors. Moreover, the literature revealed that there were strategies that could be adopted to improve

students with visual impairment performance in mathematics in many countries around the world. Some of these strategies according to the literature were role of the society and parents, peer tutoring, verbal description of instruction, resource teacher support, students' positive attitudes towards homework and teacher in-service training.

Most of the empirical studies which were reviewed such as Idol (2006), Beth (2015), Maguvhe (2015), and Spungin and Ferrell (2010) did not triangulate the responses of the respondents therefore, much details were not ascertained. However, the currents study triangulated the interview responses of the teachers to confirm the questionnaire results of the students to further give a more detailed and balanced picture of the situation. Again, most of the studies were conducted in different countries across the world and they focused on secondary schools, but this current study was conducted in Ghana National and St. Joseph basic school in Ghana and it focused on basic schools. This current study is therefore appropriate in filling the gap created by studies into the performance of students with visual impairment in mathematics in Ghana National and St. Joseph basic schools in Ghana.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter presents the methodology for the study. The areas covered were: research approach, research design, population, sample size, sampling techniques, instrumentation, validity, reliability, procedure for data collection, method of data analysis, and ethical considerations.

3.1 Research Approach

The study employed mixed method approach to find out performance of students with visual impairment in mathematics in Ghana National and St. Joseph Basic Schools at Cape Coast, Central Region of Ghana and Bechem, Ahafo Region respectively. Mixed method research has been defined as a philosophically underpinned or organized model of inquiry combining quantitative and qualitative models of research so that evidence may be mixed and knowledge is increased in a more meaningful manner than either model could achieve alone (Creswell, 2007).

Again, mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e. g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration (Johnson, Onwuegbuzie & Turner, 2007).

A mixed method approach was adopted to find out the following about students with visual impairments in the two selected schools: 1) their performance in mathematics; 2) factors that influence their performance mathematics, and 3) strategies that could be adopted to improve their performance in mathematics. First, the researcher used the quantitative approach to find out the students' level of

performance, teacher-related factor, student-related factors and school-related factors that are influencing students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana.

The quantitative aspect of this study helped to quantify the problem by way of generating numerical data or data from the field and transform them into useable statistics. Ogula (2005) stated that quantitative research is the collection and analysis of numerical data to describe, explain and predict phenomena of interest. Ogula further explained that numerical data is used to perform statistical analysis and the results are then used to answer the questions of the study which then serve as a generalization to the target population. Qualitative research on other hand is a means of collecting information from participants in order to understand the phenomenon under the study from the perspectives of those involved in the research (Ary, Jacobs, & Sorensen, 2010). Bryman (2008) and Creswell (2003) are of the view that in qualitative reach, the participants are expected to give detailed rather than general information on the features of the specific phenomenon under investigation. The qualitative method was adopted to address the research question one which is performance of students with visual impairments in mathematics.

The philosophical rationale behind mixing of qualitative and quantitative models of research into a single study is pragmatism. Morgan (2007) explained that pragmatism supports researchers in choosing between different models of inquiry as research questions being addressed intrinsically determine which methods are best suited, that is, some research questions are best addressed using qualitative analysis while others using quantitative methods. The pragmatic philosophy behind this study allowed for organized application of appropriate.

3.2 Research Design

Research design is a plan, structure and strategy of investigation conceived so as to obtain answers to research questions and control variance (Creswell, 2003). Omari (2011) also defined research design as a distinct plan on how a research problem will be attacked. In this study, explanatory sequential design was adopted to collect the data. Explanatory sequential design is a type of design which consists of first collecting quantitative data and then collecting qualitative data to help explain or elaborate on the quantitative results (Creswell & Plano, 2011). This design, according to Subedi (2016), involves two phases of which the qualitative data are collected and analyzed in second phase to help build on the first, quantitative phase, and the two phases are connected in the intermediate state in the study. In this regard, the quantitate data was collected and analyzed two months before the qualitative data. The purpose for the qualitative data was to confirm the quantitative data collected.

Again, the qualitative data was collected to elicit some information about the students of which the quantitative data does not entail. Subedi (2016) explained that, the rationale for this approach is that the quantitative data and the qualitative data and their analysis refine and explain those statistical results by exploring participants view in more depth. Therefore, the rational for using explanatory sequential design in this study was to find out the views of students and teachers on the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Junior High schools (JHS 1-3).

3.3 Population

The population for the study was 281. This comprised of 262 students from form one to form three classes of Ghana National and St. Joseph Basic Schools. The teachers' population comprised 19. Out of the 262 students, 138 were male and 124 were female. Again, out of 19 teachers 12 were males and 7 were females. The age range of the population was between 11 and 45 years with an average age of 15 years. The researcher used this population because it was the total number of the two schools out of which the sample size was taken from.

The population is presented in Table 1.

Population distribution of respondents

Schools	Population	Male teachers	Female teachers	Male Students	Female students
Ghana National Basic	135	6	4	66	59
St. Joseph Basic	146	6	3	72	65

Source: Researcher's Computations from field Data, April, 2019

3.4 Sample

The sample size for the study was 62. Out of this, 60 were students of which 32 were males and 28 were females. Again, 2 were teachers who consisted of 1 male and one female. Also, out of the 60 students, 21 were students with low vision and 39 were students with blindness. Seventeen (17) of the students were JHS 1 students, twenty (20) were JHS 2 students and twenty-three (23) were JHS 3 students. Pupils with visual impairments from nursery to class six (6) were not included in the study because the study considered only students with visual impairments who had one or three years learning experience in mathematics in Ghana National and St. Joseph Junior High Schools in Ghana. Moreover, the 2 teachers were teachers who taught mathematics to students with visual impairments and had at least 5 years experiences

in teaching in the same schools. Furthermore, the students were offering eight subjects but the researchers' interest was to find out their performance in mathematics. Finally, the two schools, Ghana National Basic School at Central Region and St. Joseph Basic School at Ahafo Region were inclusive basic schools.

An effective sample is one that attempts to be as diverse as possible and should use a large sample so that any generalization to the whole population would be done with confidence (Kombo & Tromp, 2006). Creswell (2009) is of the view that sample size refers to a sub-group of the target population that the researcher plans to study for the purpose of making generalization about the target population.

Table 2:
The Sample Size involved in the study

Schools	Sample size	Male teachers	Female teachers	Male SWVI	Female SWVI	Students with blindness	Students with low vision
Ghana National Basic	29	0	1	15	13	18	10
St. Joseph Basic	33	1	0	17	15	21	11

Source: Researcher's Computations from field Data, April, 2019
Key: SWVI = Students with Visual Impairments

3.5 Sampling Technique

The researcher employed purposive sampling technique to select the participants for the study. The researcher purposefully chose the students with visual impairment because they have been diagnosed to having visual impairments and have been learning mathematics in the school for more than one academic year, hence, were in the best position to provide relevant information relating to factors that could influence their performance in mathematics. The teachers were chosen because they had general information about the performance of all students and could know or be a

factor of influencing students with visual impairment performance in mathematics. Again, teachers were selected depending on their experience in teaching mathematics to students with visual impairments. Fraenkel and Wallen (2009) explained that purposive sampling technique is a technique in which researchers use their judgment to select a sample that they believe, based on prior information, will provide the data they need. Creswell (2002) stated that, in purposive sampling, the researcher intentionally sellect site and individuals to learn or to understand a phenomenon. Avoke (2005) also contended that in purposive sampling technique the researcher handpicks the cases to be included in the sample on the basis of their judgment of typicality. This means that in purposive sampling, respondents are chosen on the basis of their knowledge of the data preferred. In using a purposive sample, a researcher initiates with specific viewpoints in mind that he or she wishes to examine and then seeks out research participants who cover that full range of perspectives. Some scholars argue that purposive sampling techniques are more suitable for studies located within the qualitative framework than studies that fall within the quantitative framework (Creswell, 2005, Gall, Gall, & Borg, 2007; Kusi, 2012).

3.6 Research Instruments

The researcher employed the following 3 types of data collection instruments:

- Documentary analysis
- Questionnaires
- Semi-structured interview guide

The selections of these tools were guided by the nature of the data to be collected as well as the research questions for the study. The use of several research instruments or methodological triangulation is the surest way of minimizing threat to both internal and external validity (Altrichter, Feldman, Posch & Somekh, 2008).

They further contend that triangulation gives a more detailed and balanced picture of the situation. In the same vein, Cohen and Manion (2003) regard triangulation as an attempt to map out, or explain more fully. The researcher used more than one instruments for this study because total dependence on one instrument may distort or may lead to biasness on a particular piece of information (Kothari, 2004).

3.6.1 Documentary analysis

Documents which consist of students' exercise books and terminal report cards from term one to term three were reviewed. Documentary analysis was adopted in this study to determine the actual performance of students with visual impairments in mathematics in Ghana National and St. Joseph basic schools in Ghana. In this regard, documentary analysis in this study was focus on research question one raised, namely: what is the level of performance of students with visual impairments in mathematics in Ghana National and St. Joseph basic schools in Ghana? Documentary research is the use of outside sources, documents, to support the viewpoint or argument of an academic work (Omari, 2011). According to Mitchell and Jolley (2009), a document analysis guide is a critical examination of public or private recorded information related to the study. They also stated that it enables the researcher to obtain data that are accurate because the respondents have given attention to their compilation. It also saves time and expenses in transcribing because the records are analyzed as they were obtained. Blaxter, Hughes, and Tight (2006) asserted that documents are secondary data and they include books and journals, institutional documents, etc. The author added that, they are gathered from many sources including government ministries, district and municipal education offices, central administration of universities and colleges and sometimes too on the government websites.

3.6.2 Questionnaires

Creswell (2002) defined questionnaire as a document or form used of which participants in a study complete and returns to the researcher. Creswell further stated that, participants mark choices to questions and supply basic personal or demographic information. Questions according to Cohen and Morrison (2003) are quick to compile and straight forward to code, and do not discriminate unduly on the basis of how articulate the respondents are.

One form of Likert scale questionnaire item was developed to collect data from the respondents. These respondents were students. Likert scale is a type of scale that measures the difference between individuals (Awanta & Aseidu-Addo, 2008). Awanta and Aseidu-Addo further explained that, Likert scale effectively asks respondents to indicate their level of agreement with statement to express interest, opinion and attitudes. Thus, respondents were expected to make their choices from a four point Likert scale rated items by ticking (√) in the created boxes of columns where they Strongly Disagree (SD); Disagree (D); Agree (A) and Strongly Agree (SA). The strongly agree exhibited the most powerful weight of 4 followed by agree which exhibited the weight of 3. Again, disagree exhibited the weight of 2 whiles strongly disagree was the lowest weight which exhibited 1 on the scale to the issues discussed. 33 Likert scale questionnaire items were designed for the students' respondents. Each of the questionnaires for the students had three sections. Section "A" dealt with biographic data of the respondents. Section "B" sought information on the factors that influence students with visual impairment performance in mathematics and section "C" sought for information on the strategies that could be adopted to improve on the performance of the students with visual impairment. Questionnaires

were used because it enabled the researcher to reach a large sample within a short time (Creswell, 2003).

3.6.3 Interview Guide

The researcher used semi-structured interview on teacher' participants. Interview is one of the main techniques used to collect data in qualitative research (Frankel & Wallen, 2009). The interview was guided by the themes in the research questions two and three raised, namely, factors influencing students with visual impairments performance in mathematics and strategies that could be adopted to improve students with visual impairment in mathematics. The interview did not cover research question one raised because research question one was about the level of performance of students with visual impairments in mathematics of which documentary analysis was used as the best instrument which can provide accurate data. In the interviews, the researcher included probes and prompts to aid further exploration of his own line of questioning. The probes and prompts helped to explore and develop views of respondents and to prevent respondents from going off the main line of questioning (Rodgers, 1999). One- on-one, face-to-face was applied. To do this, the same questions needed to be asked in each interview (Dawson, 2002).

3.7 Pre-Testing

The questionnaire was pre-tested on 11 students with visual impairments in University of Education, Winneba, who completed Ghana National Baisc School three years earlier. These students did not take part in the actual study. A 30 Likert scale questionnaire items were designed for the students' respondents. The researcher chose the said students because the students shared the same characteristics as those chosen for the study. The purpose of the pre-test was to establish the validity and

reliability of the questionnaire by checking for clarity of items, instructions and layout, as well as to gain feedback on the questionnaire (Cohen, Manion, & Morrison, 2007). The pre-test was conducted to determine whether the questionnaire would be understood by the sample to be used. Results from the pre-test informed the researcher on whether the participants understood the questions in the instrument. This offered the researcher an opportunity to modify the questionnaire. This resulted in altering some of the items which needed further clarification, to fine-tune the questionnaire for the main study. Moreover, the pretest in this study was essential because the researcher wanted to find out whether the items of instruments were accurate and comprehensive enough to give the projected type of data and determine whether the research objectives were fulfilled. In other hand pretest help the researcher to test for how long it will require information to complete the instrument to be used for the study.

3.8 Validity of the Instruments

Validity is the extent to which an instrument measures what it is supposed to measure and performs what it is designed to perform (Kombo & Tromp, 2006). A research instrument is valid if its content is relevant and appropriate to research objectives raised by the researcher. In this regard, the content validity was adopted where the interview guide and questionnaire items were carefully designed to cover the key themes raised in the research questions.

According to Johnston and Vanderstoep (2009) the ability of an instrument to measure what it is intended to measure is known as validity of the instrument. In view of this the instruments were presented to the supervisor for further comments and improvement hence all necessary corrections were made and items which found unfitting were removed. To ensure trustworthiness, responses for the interview were

played to respondents to listen immediately after the interviews were conducted to make sure what were recorded were really respondents' views. Again, the interviews were conducted in the natural setting of the participants which is the office of the participants in the school. Macmillan and Schumacher (2001) indicated that participants' in-depth interviews need to be conducted in natural settings to reflect the reality of life experiences more accurately than do laboratory settings.

The researcher was assured that the results of the study had to be generalized from the sample to the population and the instruments accurately assess what the study intended to know. The use of questioner, interview, and documentation in this study allowed triangulation of the data. Triangulation is a method of cross-checking data from multiple sources to search for regularities in the research data (Punch, 2003). The use of triangulation in this study therefore increased the validity of the result.

3.9 Reliability

Reliability means that scores from an instrument are stable and consistent (Creswell, 2012). Again, reliability is the degree to which a measuring procedure gives or provides similar results over a number of repeated trials (Orodho, 2004). This means that for an instrument to be reliable, scores should be nearly the same when researchers administer the instrument multiple times at different times (Creswell, 2012). Fraenkel and Wallen (2003) added that reliability is the extent to which items in an instrument generate consistent responses over several trials with different respondents in the same setting or circumstance.

Furthermore, reliability of the questionnaire items were determined through the Cronbach's Alpha using Statistical Package for Social Sciences (SPSS) version 20. The Cronbach's Alpha reliability coefficient measures the internal consistency

among questionnaire items on a Likert scale. The results were shown in the table 3 below:

Table 3:

Summary of reliability tests results

Respondents	Number of students	Number of items	Alpha
Students	11	32	0.83

Source: Researcher's Computations from the Pretest Data March, 2018.

Atindanbilla (2013) indicated that co-efficient of reliability value is considered good and reliable if it is above 0.7. Berthoud (2000) also indicated that a reliability coefficient of 0.6 and above is satisfactory for any research instrument. Zaiontz (2016) explained that the acceptable variables for alpha, range from 0.70 to 0.95. Since, the Cronbach's Alpha coefficient for this study is 0.83, it can be explained that the internal consistency is good and the research instrument is reliable. The main reason for pre-test for this study is to detect ambiguities, deficiencies and weaknesses in the instrument for correction and modification so as to improve the internal consistency of the instrument (Alumode, 2011).

3.10 Procedure for Collecting the Data

The researcher always observed the ethics of research. According to Heather, Alan and Rod (2001) some of the ethical issues to consider normally when undertaking a study include privacy, confidentiality and sensitivity to cultural differences, gender and anonymity. The researcher sought permission from the two heads of the schools of which participants were involved in the study. Permission was also sought from the Ghana Education Service at Bechem and Cape Coast branch in Ghana. Creswell (2012) maintained that it is important to respect the site where a research takes place. This respect, according to Creswell, is shown by gaining

permission before entering the site. Permission to the site was facilitated by an introductory letter that the researcher requested from the Department of Special Education, UEW. A pre-visit was made by the researcher to the two schools to explain the purpose of the study to participants. Participants were assured of the necessary confidentiality of information to be gathered and to book appointments with them. Due to the number of hours students spend in the school, schedules of participants were made to meet the participants during the school hours on Wednesday 17th and Thursday 18th April, 2019. The researcher used these days because they are days the respondents had time for the researcher. The participants were given the opportunity to express their feelings and experiences without undue pressure on them. The researcher took pictures of the student's exercise books and terminal report to confirm the responds that came out from the questionnaire. The researcher went through the students' final year results to determine their general performance in final examination; this helped the researcher to determined actual performance of the students.

3.10.1 Questionnaire

The questionnaires were administered to the participants by the researcher in their classrooms. The participants were given the opportunity to express their feelings and experiences without undue pressure on them. Prior to giving out the questionnaires, the researcher adequately explained how the student participants were to answer the questionnaire.

3.10.2 Interview

The semi-structured interview guide was used to collect data for the study. The teachers were interviewed on one-on-one basis. The one-on-one interview

approach was used for the teachers because they were in different schools. The researcher found the one-on-one interview appropriate because it gives more accurate answers to research questions. Again, one-on-one interview approach enables the participants to share their views willingly. Creswell (2005) supported this when he noted that; one–on-one interview is ideal for interviewing participants who are willing to speak, articulate and who can share ideas comfortably.

The interviews were conducted in the office of the participants in the school and lasted between 35 minutes to 40 minutes. Responses from the participants were recorded on a tape recorder for easy transcription. The interview questions were asked from an interview guide, but the researcher asked other related questions which were not on the interview guide.

3.11 Data Analysis

The data analysis process was done quantitatively and qualitatively. The analysis of the data was done by analyzing the document and the questionnaire followed by the analyses of the interview.

3.11.1 Analysis of the document and questionnaire data

Data from the documentary analysis facilitated and supported the quantitative data. After completing data collection process, the researcher checked for completeness of the questionnaire before embarking on compiling and coding the data. The quantitative data was tabulated and analysed using descriptive statistics. The coded data was entered into Statistical Packages for Social Sciences (SPSS) spreadsheet after which formulae was applied to determine the percentages of the variables under study using simple percentages and tables for ease of evaluation and summarization. SPSS is a software which is used to analyse information which is quantitative in nature. Scores were used for the coding to make them possible to be

fed into the computer in other to know the themes that emerged from each research question. Furthermore, in the discussions, the responses to Strongly Agree (SA) and Agreed (A) on the scale were combined and those with Strongly Disagree (SD) and Disagree (D) were also combined to have the same meaning.

3.11.2 Analysis of interview data

The qualitative data obtained using interview was analysed by considering major themes to remove relevant information. This helped the researcher to make description of the data collected from the field basing on research objectives and derived conclusion on what to take regarding its usefulness. Actual responds from the questioner, interview was used in reporting the data where necessary. According to Kothari (2004) data analysis is a process of editing, coding, classification, and tabulation of collected data.

3.12 Ethical Considerations

Kimmel (1996) is of the view that ethical considerations are very necessary in conducting any type of research with human subjects to protect the welfare and rights of research participants. To ensure that participants' health, safety, respect, and fidelity is sustained, the researcher sort for verbal consent of participants, that is, students with visual impairments and the teachers from the two schools had the opportunity to voluntarily participate in the study. To ensure total confidentiality the researcher explained to participants that their names will not be needed in the course of data collection. The purpose of the study was explained to the participant to ensure that the participant had understood before the researcher gave the questionnaires out to the participant and treated the rights of the respondents with utmost care. Again, the researcher sought the permission of participants to use their exercise books to confirm

their responds from the questionnaire. The participants were assured that they could have access to the findings of the study and that they could contact the researcher if they had problems concerning this study. The study also has acknowledged any reference made on other researchers and scholarly works. The researcher tried to keep to the timelines set so as the results of the study can be of use in a time frame set.

CHAPTER FOUR

INTERPRETATION OF RESULT AND FINDINGS

4.0 Introduction

This chapter presents the results and interpretation of the study in order to tackle the stated objectives of the study. The stated objectives included a) find out the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana. b) Identify factors which influence the performance in mathematics of students with visual impairments in Ghana National and St. Joseph Basic Schools in Ghana. c) Investigate strategies that could help improve the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana. Documents, structured questionnaire, and interview guides were designed and used to gather the data for the study.

4.1 Demographic Characteristics of the Respondents

This section dealt mainly with the distribution of the respondents by gender, age, class/form of students and level of impairment. The data on the background characteristics of the respondents were analysed using frequency and percentage distributions. The results are presented in Tables 4 and 5 below:

Table 4:

Demographic information of the students' respondents

Variables	Options	Frequency	Percentage (%)
Gender	Male	32	53.0
	Female	28	47.0
Age	13-19	54	90.0
	19+	6	10.0
Class of students	Form 1	21	35.0
	Form 2	18	30.0
	Form 3	21	35.0
Level of impairment	SWLV	39	65.0
	SWB	21	35.0

Source: field data, 2019

The data presented in Table 4 show that, out of the 60 students who were involved in the study, 53% (32) of them were males whiles the remaining 47% (28) were females. Concerning age, data gathered from respondents on age distribution revealed that, 90% (54) of the respondents were within the age range of 13-19 years, 10% (6) were above 19 years. In terms of class level, 35% (21) of the students who participated in the study were in form one. Again, 30% (18) represented the form two class, whiles 35% (21) were in form three. Moreover, students' responses indicated that 65% (39) of them were students with low vision whiles 35 % (21) of them were blind.

Table 5:

Demographic information of the teachers' respondents

Variables	Options	Frequency	Percentage (%)
Gender	Male	1	50.0
	Female	1	50.0
Age	20-30	0	0
	30+	2	100.0
Nature of schools	Include schools	2	100.0
Highest education level	Diploma	0	0
	Bachelor's Degree	2	100.0
Number of years in teaching profession	Over 5 years	2	100.0

Source: Field data, 2019

The data presented in table 5 shows that, out of the two class teachers, 50% (1) was male and the remaining 50% (1) was female. In terms of age, both teachers were t above 30 years of age. Concerning the nature of the schools in which teachers teach, both teachers were teaching in inclusive schools. In terms of educational level, 100% (2) of the class teachers had bachelor's degree qualification. Again, in terms of the

number of years the class teachers had spent in their various schools, 100% (2) of the respondents indicated they had spent more than 5 years.

4.2 Research Question 1: What is the level of performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana?

This research question sought to find out the level of performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana. Forty-nine (49) out of the sixty (60) students with visual impairments exercises and homework books in addition to sixty (60) terminal report cards of the sixty (60) students for three different terms were used. Forty-nine (49) students' exercises and homework books were used because the remaining eleven (11) students brought back their homework to school undone whiles some refused to do exercise. Reasons given were that they could not get someone to assist them. For each of the forty-nine (49) students, ten different scores from class exercises and homework books for three different terms were put together and recorded out of 100. The scores of the students were put under nine categories of themes which included lowest (0-34 marks), lower (35-39 marks), low (40-49 marks), low average (50-54), average (55-59 marks), high average (60-69 marks), high (70-79 marks), higher (80-89 marks) highest (90-100 marks). The researcher used these scales of assessment because it was the accepted scales of assessment used by Ghana Education Service (GES).

4.2.1 Results of students' documents reviewed

The results of students' exercises and homework books together with the terminal report cards were presented using percentages. The results are summarized in Table 6, 7 and 8 below:

Table 6:

Results of the students' ten (10) combined exercises and homework

	Frequency	Percentage %
Lowest	8	16.3
Lower	15	30.6
Low	10	20.4
Low average	9	18.4
Average	4	8.2
High average	1	2.1
High	2	4.1
Higher	0	0
Highest	0	0
Total	**49**	**100**

Source: field data, 2019

From Table 6, eight students, representing 16.3% scored 0-34 marks and fall within the lowest range. Again, fifteen students representing 30.6 % scored 35-39 marks and fall within the lower range. Similarly, ten students representing 20.4% scored 40-49 marks and fall within the low range. Furthermore, nine students representing 18.4% scored 50-54 marks and fall within the low average range. Four students representing 8.2% scored 55-59 marks and fall within the average range. Additionally, only one student representing 2.1% scored 60-69 marks and was recorded within the high average range. Two students representing 4.1% scored 70-79 marks and fall within the high range. Finally, none of the students scored 80-89 or 90-100 marks.

It can therefore be concluded that the performance of students with visual impairment in mathematics in Ghana National and St. Joseph Basic Schools was below average, since majority of the student's marks fall within lowest, lower, low and low average range.

Table 7:

Results of student with visual impairment performance in basic mathematics operations (from students' exercises and homework books)

Basic Mathematical Operations		Frequency	Percentage	*(M)*	*SD*
Addition	**Lowest**	**10**	**20.4**	**1.94**	**1**
	Lower	11	22.4		
	Low	20	40.8		
	Low average	3	6.10		
	Average	5	10.2		
	High average	0	0		
		49	**100**		
Subtraction	**Lowest**	**5**	**10.2**	**1.94**	**0.79**
	Lower	17	34.7		
	Low	7	14.3		
	Low average	18	36.7		
	Average	2	4.1		
	High average	0	0		
		49	**100**		
Division	**Lowest**	**33**	**67.3**	**1.47**	**0.77**
	Lower	10	20.0		
	Low	3	6.1		
	Low average	3	6.1		
	Average	0	0		
	High average	0	0		
		49	100		
Multiplication	**Lowest**	**35**	**71.4**	**1.61**	**0.91**
	Lower	7	14.3		
	Low	6	12.2		
	Low average	1	2.0		
	Average	0	0		
	High average	0	0		
		49	**100**		

From Table 7, ten of the students representing 20.4% performance in addition was lowest, eleven of the students representing 22.4% performance in addition was lower, twenty of the students representing 40.8% performance in addition was low, three of the students representing 6.10 performance in addition was low average and five of the students representing 10.2% performance in addition was average with mean *(M)* of 1.94 and standard deviation *(SD)* of 1.0.

Again, it was revealed from the findings that five of the students representing 10.2% performance in subtraction was lowest, seventeen of the students representing 34.7% performance in subtraction was lower, seven of the students representing 14.3% performance in subtraction was low, eighteen of the students representing 36.7% was low average and two of the students representing 4.1% performance in subtraction was average with mean (*M*) of 1.94 and standard deviation (*SD*) of 0.79. Also, the data revealed that thirty-three of the students representing 67.3% performance in division was lowest, ten of the students representing 20.4% performance in division was lower, three of the students representing 6.1% performance in division of numbers was low and three of the student representing 6.1% performance in division low average with mean (*M*) of 1.47 and standard deviation (*SD*) of 0.77.

To add to, it was revealed from the findings that thirty-five of the students representing 71.4% performance in multiplication of numbers was lowest, seven of the students representing 14.3% performance in multiplication was lower, six of the students representing 12.2% performance in multiplication of numbers was low and one of the students representing 2.0% performance in multiplication was low average with mean (*M*) of 1.61 and standard deviation (*SD*) of 0.91.

In conclusion, it was clear from the findings of students' exercises and homework books that, majority of the students (74.4%) and (67.3) performance in multiplication and division operations respectively was lowest whiles few of the students (10.2%) and (20.4%) performance in subtraction and addition operations respectively was lowest. However, majority of the students (40.8%) and (36.7%) performance in addition and subtraction was low and low average respectively.

Table 9:

Result from students' terminal report cards

	Frequency	**Percentage**
lowest	15	25.5
Lower	12	20.0
Low	20	33.3
Low average	6	10.0
Average	2	3.0
High average	5	8.3
High	0	0
Higher	0	0
Highest	0	0
Total	**60**	**100**

Source: field data, 2019

From Table 7, fifteen students, representing 25% scored 0-34 marks from their terminal report cards and are within the lowest range. Again, twelve students representing 20% scored 35-39 marks from their terminal report cards and fall within the lower range. Similarly, twenty students representing 33.3% scored 40-49 marks from their terminal report cards and fall within the low range. Furthermore, six students representing 10% scored 50-54 marks and fall within the low average range. To add to, two students representing 3% scored 55-59 marks and fall within the

average range. Additionally, five students representing 8.3% scored 60-69 marks from their terminal report cards and fall within the high average range. Finally, none of the students scored 70-79 marks, 80-89 marks and 90-100 marks.

In conclusion, it was clear from the findings of students' terminal report cards that, students with visual impairment performance in mathematics was low. This was evidence when majority of the students representing 33.3% performance from their terminal report cards was low.

4.3 Research Question 2: What factors influence the performance of students with visual impairments in mathematics at Ghana National and St. Joseph Basic Schools in Ghana?

This research question sought to find out factors that influence the performance of students with visual impairments in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. A four-point Likert scale items numbered 1-33 were used to measure the extent of agreement or disagreement of students on the factors that influence their performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. Again, semi-structured interview guides were used to solicit the views of the teachers as well. Their responses were described in terms of means, standard deviations and verbatim descriptions. Any of the means which was less than 2.5 were regarded a disagreement whilst those that were higher than 2.5 were regarded as agreement. The results were represented in Tables and transcriptions below:

Table 10:

Responses of students on teacher-related factors that have influence on their performance in mathematics at Ghana and St. Joseph Basic Schools in Ghana

Statements	N	Mean	Std. Deviation
Teachers' attitudes and beliefs on students' performance in mathematics			
My mathematics teacher frequently absent himself during mathematics class or lesson	60	1.86	1.117
My mathematics teacher come to class late during mathematics lesson or class	60	2.55	1.108
My mathematics teacher encourages me to pursue higher level in mathematics education	60	2.15	.732
My mathematics teacher believes that mathematics is difficult for me to understand?	60	4.03	.938
Pedagogical content knowledge teachers have in teaching mathematics to students with visual impairments			
I get inspire during mathematics lesson	60	2.05	1.126
My mathematics teacher deliver mathematics content to my understanding	60	1.87	1.112
Teachers' instructional methods influencing performance in mathematics			
My mathematics teacher revises previous lessons with us during mathematics lesson	60	2.04	1.375
I understand the language my mathematics teacher uses during mathematics lesson	60	2.01	1.385
My mathematics teacher puts us in groups during mathematics lesson	60	1.86	1.117
Teachers' knowledge about students with visual impairment and performance in mathematics			
My mathematics teacher believes that students with visual impairment can learn mathematics	60	2.03	1.376
My mathematics teacher spells out what he writes on the chalkboard	60	1.72	.904
My mathematics teacher speak clearly in a normal voice during mathematics class or lesson	60	2.49	1.378
Teachers' qualification and students' performance in mathematics			
My mathematics teacher put the blame on me if I did not understand mathematics concept	60	3.17	1.553

My mathematics teacher always make sure that the classroom is well organized during mathematics lesson	60	1.99	1.863

Source: field data, 2019

Table 8 shows the responses of students on teachers-related factors that influence students with visual impairments performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. On the statements which sought responses on teachers' attitudes and beliefs on students' performance in mathematics, notably, the respondents disagreed to the fact that, "my mathematics teacher frequently absent himself during mathematics class or lesson" (M=1.86, SD=1.117). However, the respondents agreed to the fact that, "my mathematics teacher come to class late during mathematics lesson or class" (M=2.55, SD=1.108). Conversely, respondents disagreed to the fact that their mathematics teacher encourages them to pursue higher level in mathematics education (M=2.15, SD=.732). Yet, the respondents agreed to the fact that "my mathematics teacher believes that mathematics is difficult for me to understand" (M=4.03, SD=.938).

In terms of pedagogical content knowledge teachers have in teaching mathematics to students with visual impairments, students' participants disagreed that, they get inspired during mathematics lesson (M=2.05, SD=1.126). Respondents further disagreed to the facts that "my mathematics teacher deliver mathematics content to my understanding" (M=1.87, SD=1.112).

To add to, respondents disagreed with the statements which solicited responses concerning instructional methods influencing performance in mathematics. Notably, the students asserted that, "my mathematics teacher revises previous lessons with us during mathematics lesson" (M=2.04, SD=1.375). Again, students responses disagreed to the statement that, 'I understand the language my mathematics teacher uses during mathematics lesson or class" (M=2.01, SD= 1.385). Furthermore, they

disagree to the fact that, “my mathematics teacher put us in groups during mathematics lesson” (M=1.86, SD=1.117).

Stressing further, respondents differed views on the statements that solicited responses from students concerning the level of teacher’s knowledge about students with visual impairment and performance in mathematics. Thus, the respondents disagreed to the statement that, “My mathematics teacher belief that students with visual impairment can learn mathematics” (M=2.03, SD=1.376). In addition, the respondents disagreed to the fact that, “my teacher spell out what he writes on the chalkboard” (M=1.72, SD=.904). Furthermore, the respondents disagreed to the statement that “My mathematics teacher speak clearly in a normal voice during mathematics class or lesson” (M=2.49, SD=1.378. Finally, regarding the statements concerning teachers’ qualification and students’ performance, respondents affirmed that “my mathematics teacher put the blame on me if I did not understand mathematics concept” (M=3.17, SD=1.553) and disagreed that “my mathematics teacher always make sure that the classroom is well organized during mathematics lesson” (M=1.99, SD=1.863).

Generally, it was clear from the analysis of respondents (Table 8) that, teachers’ attitudes and beliefs on students’ performance in mathematics (M=4.03, SD=.938), teacher’s qualification on student’s performance (M=3.17, SD=1.553), teachers’ instructional methods (M=1.86, SD=1.117), teacher’s knowledge about students with visual impairments (M=1.72, SD=.904) and pedagogical content knowledge teachers have in teaching mathematics to students with visual impairments (M=1.87, SD=1.112) are teacher-related factors that have influence on students with visual impairments performances in mathematics. This implies that the low performance in mathematics among students with visual impairments at Ghana

National and St. Joseph basic schools in Ghana was as a result of some teacher-related factors.

Table 11:

Responses of students on student-related factors that have influence on their performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana

Statements	N	Mean	Std. Deviation
Students' attitudes and performance in mathematics			
I enjoy learning in mathematics class	60	1.32	.792
I have developed confidence in mathematics	60	1.57	.927
I practice mathematics concepts that I have been taught in class on my own	60	1.43	.843
I am happy for the mathematics skills that I have gained	60	2.82	1.467
I understand mathematics concept well when I discover new methods of solving them on my own	60	2.53	1.359
I do absent myself from mathematics class	60	2.54	1.375
I wish mathematics should be taken away from the syllabus	60	4.44	.884
Peer support and performance in mathematics			
I receive support from my colleague students in mathematics lesson	60	4.50	.873
I am able to share new ideas during mathematics discussions with my peers	60	3.63	1.426
I understand better when I solve mathematics problems in class with my peers supporting me	60	3.27	1.539
My friends encourage me to learn mathematics	60	3.38	1.462

Source: Field data, 2019

Table 9 shows the responses of students on students-related factors that have influence on students with visual impairments performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. On the statements which sought responses of students' attitudes and performance in mathematics, notably, the

respondents disagreed that, “I enjoy learning in mathematics class” (M=1.32, SD=.792). They also disagreed to the fact that, “I have developed confidence in mathematics” (M=1.57, SD=.927). To add to, the respondents disagreed to the statement that, I practice mathematical concepts that I have been taught in class on my own” (M=1.43, SD= .843). However the respondents agreed to the fact that, “I am happy for the mathematics skills that I have gained” (M=2.82, SD=1.467). Similarly, respondents agreed to the fact that, “I understand mathematics when I discover new method of solving them” (M=2.53, SD=1.359). Furthermore, the respondents agreed to the statement that, “I wish mathematics should be taken from the syllabus” (M=4.44, SD=.884). Finally, students’ responses agreed to the fact that, “I do absent myself from mathematics class” (M=2.54, SD=1.375).

Concerning, peer support and performances in mathematics, respondents agreed that, they receive support from their colleagues during mathematics lesson (M=4.50, SD=.873). Again, respondents affirmed that they can share new ideas during mathematics discussions with their peers (M=3.63, SD=1.467). Furthermore, respondents agreed that they solve mathematics problem better when their peers support them (M=3.27, SD=1.539). Finally, respondents agreed that their friends encourage them to learn mathematics (M=3.38, SD=1.462).

In totality, it was observed from student’s responses in Table 9 that the responses of students on student-related factors that have influence on students with visual impairments low performance in mathematics was student’s attitude which recorded a mean score of (M=4.44, SD=.884).

Table 12:

Responses of students on school-related factors that have influence on their performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana

Statements	N	Mean	Std. Deviation
Class size effect on students' performance in mathematics			
I found it difficult to understand mathematics concept during mathematics class because of the large class size	60	4.17	1.028
Educational materials are not enough for us during mathematics lesson because of the large class size	60	4.60	.494
I do not get the attention of the teacher because of large class size	60	3.97	1.134
Availability of teaching and learning resources on students' performance in mathematics			
There are available resources such as text books, abacus, talking calculators, computers, and braille materials in the schools	60	1.58	.497
I have no interest in mathematics because of lack/inadequate of mathematics materials such as textbooks, abacus, talking calculators, computers, braille materials	60	3.32	1.372
Environment noise			
The school environment is noisy for learning mathematics	60	4.48	.504
The noise in the school distract our attention during mathematics lesson	60	4.58	.497
I found it difficult to hear the voice of the teacher during mathematics lesson because of the noise in the school	60	4.62	.490

Source: Field data, 2019

Table 10 shows the responses of students on school-related factors that have influence on students with visual impairment performance in mathematics at Ghana National Basic and St. Joseph Basic Schools in Ghana. On the statements soliciting responses of students about class size effect on students with visual impairments performance in mathematics, respondents notably reported that, I found it difficult to understand mathematics concept during mathematics class because of the large class size (M=4.17, SD=1.028). Again, respondents agreed that, educational materials are not enough for us during mathematics lesson because of the large class size (M=4.60,

SD= .494). Finally, the respondents agreed to the fact that, "I do not get the attention of the teacher because of large class size" (M=3.97, SD=1.134).

In terms of availability of teaching and learning resources on students' performance in mathematics, notably, students' respond disagreed that, there are available resources such as text books, abacus, talking calculators, computers, and braille materials in the schools (M=1.58, SD=.497). However, the respondents agreed to the fact that, "I have no interest in mathematics because of lack/inadequate of mathematics materials such as textbooks, abacus, talking calculators, computers, braille materials" (M=3.32, SD= 1.372).

Concerning environmental noise, students respond agreed with the statement that, "the school environment is noisy for learning mathematics" (=4.48, SD=.504). Again, student's responses agreed that, "the noise in the school distract our attention during mathematics lesson" (M=4.58, SD=.497). Finally, respondents agreed to the fact that, "I found it difficult to hear the voice of the teacher during mathematics lesson because of the noise in the school" (M=4.62, SD=.490).

In summary, it was observed from the student' respond in Table 10 that school-related factors have influence on the students with visual impairment low performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. Environmental noise recorded the highest with the mean score of (M=4.58, SD=.497), followed by class size effect on students' performance in mathematics and availability of teaching and learning resources on students' performance in mathematics with the mean scores of (M=4.60, SD=.494) and (M=3.32, SD= 1.372) respectively.

4.4 Teachers interview responses on teacher-related factors that have influence on students with visual impairment performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana

4.4.1 Teacher-related factors

In finding out the responses of teachers on teacher-related factors that have influence on students with visual impairment performance in mathematics, interviews were conducted to engage 2 participants. The researcher sought responses of teachers based on four statements and below interpretations of their responses and some verbatim quotation of respondents

- **Teachers' qualification in teaching mathematics**

All the respondents' discussion indicated that, they have bachelor's degree in mathematics and have been teaching mathematics for more than five years in their respective schools. A teacher remarked that:

> *I hold bachelor's degree* in *mathematics and have taught mathematics for six years*. *Currently I am doing my second degree in mathematics*. (Verbatim expression by teacher "A").

Teacher B expressed that:

> *I have bachelor degree in mathematics. This is my 7th year in teaching and have taught mathematics for 5 years* (Verbatim expression by teacher "B")

Teachers' views were also sought on the satisfaction of workshops they have attended in teaching mathematics to students with visual impairment and these were some of their responses,

> *Although I have attended workshops but general ones not specifically base on how to teach mathematics to students with visual impairment* (Verbatim expression by teacher "A" in one of the schools).

Teacher "B" also commented this way:

> *Although I have attended several workshops of which some were organized by NGOs and Ghana Education Service (GES) but they were not in detail concern how to teach mathematics to students with visual impairments* (Verbatim expression by teacher 'B" in one of the schools).

It seems obvious that the teachers in Ghana National and St. Joseph Basic Schools have not attended workshops in teaching mathematics to students with visual impairment, although they have been attending workshops in different area of their professionalism. It is clear therefore that teachers need to attend workshops regularly on how to teach mathematics to students with visual impairment so that students with visual impairments low performance in mathematics can be improve.

- **Teachers' beliefs in teaching mathematics to students with visual impairment**

It could be observed from the comments of the teachers on their belief in teaching mathematics to students with visual impairment that teachers believed that mathematics as a subject is difficult for students with visual impairments to understand because mathematics is visual discipline and as a result of that students with visual impairments should not study mathematics or they should have different mathematics curriculum, consist of selected topics for the students to study.

Teacher A comments that:

> *Because of the subject and the way it is technical they are always discourage especially when I am teaching topics like shape and space because they cannot see. To me I think students with visual impairments should not study same topics with their sighted peers or should not study mathematics at all.* (Verbatim expression by teacher "A")

Teacher "B" was with the view that:

> *Student with visual impairments need not to study mathematics as a subject although mathematics is very important in this our contemporary world. This is because they found it difficult to understand the concept.* (Verbatim expression by teacher "B"

- **Teachers' instructional methods**

In relation to instructional methods, the interaction with the respondents revealed that, teachers use verbal description of instructions methods during teaching and learning process to students with visual impairment.

A teacher remarked that:

> *What I normally do is that I verbally mention whatever I write on the chalk board but because of time and the large class it is difficult for me to attend to them one after the other if I try to do that I will not finish my topics.* (Verbatim expression by teacher "A")

Teacher B expressed that:

> *It is very difficult in teaching students with visual impairment mathematics because there are inadequate teaching and learning materials available. Their performance in mathematics is encouraging when you have time for them and also when you use verbal description of instruction approach* (Verbatim expression by teacher "B").

- **Teachers' knowledge about students with visual impairment**

This theme elicited data on knowledge teachers have about students with visual impairment. Teachers' responses indicated that they do not have enough knowledge about how to teach mathematics to students with visual impairments. Teacher "A" noted that:

> *I don't have enough special education background so I found it difficult to teach mathematic to them. Sometime it pain me when I try my best and they are not getting the concept. It is indeed hard for me.* (Verbatim expression by teacher "A" in one of the schools).

Teacher "B" remarked that:

> *I don't know much about students with visual impairments but now I have gain some experience on how to teach some of the concept to the students. It very challenging although but we are managing* (Verbatim expression by teacher "B" in one of the schools).

The analysis of the teachers' comments indicated that they lack knowledge on how to teach mathematics to students with visual impairments. However, one teacher indicated that through experience he is doing better to teach students with visual impairments.

4.4.3 Student- related factors

In finding out the responses of teachers' on student-related factors that have influence on students with visual impairment performance in mathematics, the researcher sought responses of teachers based on two statements and below interpretations of their responses and some verbatim quotation of respondents.

- **Attitude of students with visual impairment towards mathematics**

In relation to the students' attitudes towards mathematics the respondents revealed that, students with visual impairment show negative or bad attitude towards mathematics. Teacher "A" noted that:

> *Majority of the students with visual impairment do not show internet in mathematics subject. They even wish that they will stop doing mathematics because they see mathematics concept to be difficult for them to understand.* (Verbatim expression by teacher "A")

Teacher "B" stated that:

> *Hmmm!!! Students with visual impairment don't feel happy in mathematics class. Some of them absent themselves from mathematics class especially when I am teaching topics that involve diagrams. Others too sleep in class during mathematics lesson* (Verbatim expression by teacher "A").

It seems clear from the respondents that students with visual impairment show negative attitude towards mathematics. They do not have interest in mathematics subject. It can therefore conclude that students' attitudes towards mathematics can influence their performance.

- **Peer support**

The results of teachers' during the interview indicated that, student with visual impairments received support from their sighted peer in mathematics and this boost their ability to actively participate in teaching and learning of mathematics. Below are some of the verbatim responses of teacher "A" when this question was asked, "what support/s does the students with visual impairment received from their peers who are sighted"?

> *Students with visual impairment sighted friends guide them in doing their assignment and also in the classroom when the students are put in groups for mathematics task.* (Verbatim expression by teacher "A")

Teacher B stated that:

> *The support that students with visual impairment received from their peer is peer tutoring this is when the students get free time or during break time and it is helping the students with visual impairment performance in mathematics.* (Verbatim expression by teacher "A")

4.4.3 School-related factors

In finding out the responses of teachers on school-related factors that have influence on students with visual impairments performance in mathematics, the researcher sought responses of teachers based on six statements and below interpretations of their responses and some verbatim quotation of respondents.

- **Class size**

Responses of the teachers further revealed that, large class size negatively influence the performance of students with visual impairment in mathematics. Some of the verbatim responses of the teachers are below:

Teacher A, indicated that,

> *The students are many so attending to them one after the other makes the work difficult. And because they are many they disturb a lot making teaching difficult for me as a teacher. The students can perform if the class size is small because I can attended to them one after the other and also there be no disturbances. Also the resources available are not enough due to the large class size (*Verbatim expression by teacher "A").

Teacher B noted that:

> *I belief students with visual impairments performance is not encouraging because of how the class is large, the reason is that when I have time for the students on-on-one during break time I can see that they get the concept*. (Verbatim expression by teacher "B").

- **Nature of the mathematics curriculum**

In relation to the nature of the mathematics curriculum in the basic school the respondents revealed that, although the mathematics curriculum is not too large for students with visual impairment but there are some of the topics that are difficult to teach for the students to understand.

Teacher "A" remarked that:

> *There are some topics that students with visual impairment to me need not to study. For example topics in the mathematics curriculum which involves diagrams. Most of the students with visual impairment sleep in class when I am teaching mathematics topics such as constructions which involves a lot of diagrams. The mathematics curriculum is too broad for students with visual impairments. Students with visual impairments should have their own mathematics curriculum which is simple.* (Verbatim expression by teacher "A").

Teacher "B" had this to say:

> *I believe that mathematics curriculum is accessible to students with visual impairment but resource are not available this makes it difficult for the students to understand concept. Student with visual impairment can understand all the concepts in the mathematics syllabus or curriculum provided there are enough teaching and learning resource available for teachers and learners to use (Verbatim expression by teacher "B").*

It could be observed from the comments of the teachers that, one of the teachers believe that the mathematics curriculum is broad and has negative influence on the performance of students with visual impairments whiles the other teacher was with the view that mathematics curriculum is not broad to students with visual impairments but students with visual impairments are not performing in mathematic as a result of lack of resource available for teachers and students.

- **Availability of teaching and learning resources**

Ensuring the availability of teaching and learning resource at the disposal of teachers in teaching mathematics to students with visual impairments and how it influence the performance of students with visual impairment in mathematics, the respondents expressed common views on how difficult it was for them to get teaching and learning resources to teach mathematics to students with visual impairments. They registered their dissatisfaction regarding the limited resources they have at their disposal. Below was the summary of teacher "A" responses together with her verbatim responses.

> *Most of the few teaching and learning resources at our disposal were provided by the school. Sometimes too I provide them myself if could.* (Verbatim expression by teacher "A").

Teacher "B" expressed his view this way:

> *Hmmm!!! How do I get teaching and learning resources to teach students with visual impairment mathematics? As a matter of fact I don't get resources from anywhere to teach the students. The school don't provide so as the government. I try had before I could get some few by myself to teach the students.* (Verbatim expression by teacher "B").

Again, in ensuring the availability of teaching and learning resource at the disposal of teachers in teaching mathematics to students with visual impairments and how it influences the performance of students with visual impairment in mathematics, the teachers were asked to give their concern about the following

question, "how does resources limit you from teaching mathematics to students with visual impairment"?. The respondents expressed their views on how difficult it was for them to teach mathematics to students with visual impairments with limited resource at their disposal. They registered their dissatisfaction regarding the limited resources they have at their disposal. Below was the summary of teacher "A" responses together with her verbatim responses.

> *Since the teaching and learning resources in the school are few and the students are many, it makes teaching mathematics to students with visual impairment very difficult. This is because sometimes some of the student do not get some of the teaching and learning materials. Moreover students with visual impairment are exempted when topics such shape and space, construction are treated* (Verbatim expression by teacher "A").

Teacher "B" expressed his view this way:

> *I am always disturb when I am teaching mathematics to students with visual impairment because we have limited resources in the school. This has made it difficult for the students to get mathematics concept during teaching and learning and this has equally affected their performance in mathematics* (Verbatim expression by teacher "B").

It could be observed from the comments of the teachers that, availability of learning resources affect students with visual impairments performance in mathematics and makes teachers disturb when they are teaching mathematics to the students with visual impairment. It seemed clear from the analysis that the respondents were not comfortable with issues regarding the limited resources in the schools. The analysis clearly shows that because of lack of resources or inadequate teaching and learning resources students with visual impairment are exempted when certain mathematical tasks stated in the syllabus such as shape and space, constructions are treated. Teachers were concerned about the nature of the mathematics curriculum.

- **Environment noise**

It emerged from the responses that environmental noise negatively influence the performance of students with visual impairment. Some of the verbatim responses of parent are below.

Teacher "A" that,

> *Students with visual impairment are not visual learner's rather audio learner meaning they use their hearing because they cannot see. Nose in the school environment destruct them especially when their juniors are on break and they are playing, they make a lot of noise which affect their attention in class*. (Verbatim expression by teacher "A").

Teacher "B" had this to say,

> *The external noise destruct the students. Although the school is not too close to the road side but we can feel the noise of the vehicles during lesson time especially when the horns of the vehicles are blown. This makes the student with visual impairment get destructed. Sometimes they even make noise in class when a horn of vehicle is blow. Example when a horn of a vehicle is brow you will hear, "this is timber car coming, no this is two o seven" and they will be laughing while there is a teacher in the class* (Verbatim expression by teacher "B").

4.5 Research Question 3: What strategies could be adopt to improve the students with visual impairments' performance in mathematics in Ghana National and St. Joseph Basic School in `Ghana?

To understand some of the strategies that could be adopt to improve students with visual impairments' performance in mathematics in Ghana National and St. Joseph Basic School in Ghana, the researcher distributed open-ended questionnaires to the students and interviewed the teachers in the various schools. From the open-ended questionnaires and the interview findings, there were seven themes that emerged from the data. They include recruitment of more qualified mathematics teachers, use of peer tutors, resource teacher support, societal and parental support,

verbal description of instruction, student's positive attitude towards homework and teacher in-serve training.

Table 13:

Students' suggestions on strategies that would improve students with visual impairments' performance in mathematics in Ghana National and St. Joseph Basic Schools in Ghana

Students suggestion	Frequency	Percentage (%)
Recruitment of more qualified mathematics teachers by government	42	85.7%
Use of peer tutors	40	81.6%
Resource teachers support	47	95.9%
Parental support	15	30.6%
Adaptation of mathematics materials	45	75%
Grouping of students during mathematics lesson	30	50%

Source**:** field data, 2019

From Table 11, forty-two students out of sixty students representing 85.7% suggested that employment of more qualified mathematics teachers by government is one of the strategies that would improve students with visual impairment performance in mathematics at Ghana National and St. Joseph Basic School, Ghana. Again, forty out of the sixty students representing 81.6% suggested peer tutoring as a strategy that could be adopt to improve students with visual impairment performance in mathematics. To add to, forty-seven of the students out of the sixty students representing 95.9% proposed that resources teachers support must be adopt in other to improve on students with visual impairments performance in mathematics. Furthermore, only fifteen of the students out of the sixty of the students representing 30.6 % suggested that parental support is a strategy that could be adopt to improve students with visual impairment performance in mathematics at Ghana National and

St. Joseph Basic Schools in Ghana. Moreover, forty-five of the students out of the sixty students representing 75% proposed that adaptation of mathematics materials can improve students with visual impairments low performance in mathematics. Finally, thirty out of the sixty students representing 50% suggested grouping of students as a strategy that could be adopt to improve students with visual impairments low performance in mathematics in Ghana National and St. Joseph Basic Schools in Ghana.

4.5.1

Teachers' suggestions on strategies that could be adopted to improve students with visual impairments' performance in mathematics in Ghana National and St. Joseph basic school in Ghana

Resources teacher support

Ensuring the strategies that could be put in place to improve the low performance of students with visual impairment, it could be observed from the comments of the teachers that resource teacher support is one of the strategies that could be adopt to improve student with visual impairment performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. Below is how the teachers made their comments:

Teacher "A" suggested that:

> *The government of Ghana should employ resource teachers who have knowledge about mathematics to the school so that they can support the students. The reason is that time allocated for classroom lesson is limited for the students with visual impairments. Therefore if the school has resource teachers who have knowledge in mathematics the resource teachers can support them at the resource Centre.* (Verbatim expression by teacher "A").

Teacher "B" made it clear that:

> *One strategy I belief when put in place can enhance students with visual impairment performance in mathematics is that the school must have more than one mathematics teacher or resource teachers who have brailing skill so that they can transcribe the work of the students. This is because most a times the transcribers make mistakes since they may not have knowledge in mathematics or maybe their knowledge in braille is limited. (*Verbatim expression by teacher "B" in one of the schools).

Use of peer tutors

Again, it could be observed from the comments of one of the teachers that peer support is another strategies through which students with visual impairment in Ghana National and St. Joseph Basic Schools could adopt to improve students with visual impairment performance in mathematics. Only one teacher made this comment.

Teacher "A" remarked that:

> *Peer tutors could be adopt as a strategy to improve students with visual impairment performance in mathematics because I have realized that during teaching when sighted student are used as peer tutors to help students with visual impairments or students with visual impairments who understood the concept as peers to help their colleagues with visual impairments they understand better* (Verbatim expression by teacher "A" in one of the schools).

Verbal description of instruction

On the issue of verbal descriptions of instructions as a strategy that could be adopt to improve students with visual impairment performance in mathematics. Only one teacher made this suggestion.

Teacher B said:

> *Since they are visually impaired, teachers or instructors should verbally describe every single thing they do to them because sometimes if you don't describe some of the instructions to them they will not know. For instance when a teacher is teaching a topic like addition and subtraction with the help of abacus the teacher should tell what they should do at every step when using the abacus.* (A verbatim response by a teacher).

From the above comments, it was clear that verbal description of instruction is one of the strategies that could be adopted to improve students with visual impairments performance in mathematics at Ghana National and St. Joseph Basic Schools

Parental and societal support

Again, the respondents' comments revealed that another strategy that can improve students with visual impairments' performance in mathematics at Ghana National and St. Joseph Basic Schools was parental and societal support. This was evident when the respondent suggested that parents and the society should one way or the other encourage their children to have positive attitude towards mathematics. In addition, parents should visit their children in school and have belief that students with visual impairment can learn mathematics as the sighted children.

Teacher "A" had this to say:

> *If performance of students with visual impairment can be improve parents should make sure that they encourage their children to developed positive attitude towards mathematics. Parents and the society should not register it in the mind of their children that mathematics is difficult to be study by students with visual impairment. In addition, parents should also advised their children to do their homework because sometimes when you give homework to the students some of the students come to class with the question not answered* (Verbatim expression by teacher "A" in one of the schools).

Teacher "B" indicated that,

> *For students with visual impairments performance to be improve, I belief that their parents should come in. Most of the parents visit their children once in a year whiles some do not pay them visit at all. Sometimes when school vacates it is some of the teachers who send the students to their parents' whiles some of them also get to their parents with the help of their sighted peers. This I belief can negatively influence the students' performance in mathematics and not even mathematics alone all the subjects because the students may think that their parents don't see important of them being in school. (*Verbatim expression by teacher "B" in one of the schools).

Students should show positive attitude towards homework

Furthermore, ensuring the strategies that could be adopted to improve students with visual impairment performance in mathematics, teachers comment that, students with visual impairments must show positive interest or attitude towards homework. Teachers complain that most of the student fail to do their homework or assignments. Parents should therefore encourage their children to do their homework because homework helps the students to acquire new ideals and help the teachers to identify topics the students need help. Teacher "B" made comments about homework. He said:

> *Parents should also advise their children to do their homework because sometime when you give homework to the students they come back to class with the question not answered. Through homework new ideals and skills can be develop. In addition, through homework the strength and weakness of the students will be revealed which will help the teacher to know the area he/she need to reteach the student.* (Verbatim expression by teacher "B" in one of the schools).

Homework is one of the instructional tools used by teachers to determine a learner's academic engagement. Parents therefore should make sure that they advised their children to do their homework in the house or hostels.

Teachers' in-service training

To add to, it was revealed from the teachers comment that Ghana Education Service, schools, NGOs should organize in-service training for teachers who teaches mathematics to students with visual impairments. Teacher "A" affirmed this assertion in the following comments:

> *What I want to add is that, Ghana Education Service and the school must organise in-service training for teachers who teaches mathematics to students with impairment. I for instance although I have attended some in-service training but they were general training not basically on how to teach mathematics to students with visual impairment. (Verbatim expression by teacher "A" in one of the schools).*

Teacher "B" also commented this way:

> *In addition, I want to say that in-service training is also important if students with visual impairment performance in mathematics can be improve. Government or Ghana Education Service should help teachers who teaches mathematics to student with visual impairment by organizing in-serve training about how to keep to the demands of the students with visual impairment in an inclusive classroom in other to improve the performance of the students in mathematics.* (Verbatim expression by teacher 'B" in one of the schools).

It is clear therefore from the teachers comment that for student with visual impairments performance in mathematics to be improve, teachers need to attend in-service training regularly on how to teach mathematics to students with visual impairment. In addition, teachers who teaches mathematics to students with visual impairments need to attend regular staff development workshops in order to keep to the demands of the students. Furthermore, teacher's responds revealed that, although they have attended some form of in-service training yet they lack in-service training on how to teach mathematics to students with visual impairments.

Adaptation of instruction

Finally, it was revealed from the teachers comment that adaption of instruction during mathematics lesson was a strategy that teachers can adopt to improve student with visual impairment performance in mathematics. Teacher "A" affirmed this assertion in the following comments:

> *Teachers need to sure that the way students with visual impartment will understand concept of mathematics may be different from their sighted peers, hence teacher must make it a point that they will adapt the instructions when they are teaching mathematics to the students with visual impartment to suit them. For instant teachers can look the interest of the student and adopt the instruction to suit the student* (Verbatim expression by teacher 'A" in one of the schools).

From the above comments it was clear that, teachers need to adapt their instructions when they are teaching mathematics to student with visual impairment in

order create opportunity for the students to participate in mathematics lesson. Again, it was noted from the comment that teachers must adapt instruction base on the interest of the student for their participation.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.0 Introduction

This chapter presented the major findings of the research and inferences made in view of findings from related previous studies. The findings were discussed in line with the students' documents reviewed, key themes raised in the questionnaire and the interview guide.

5.1

Research Question 1: What is the level of performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana?

Results of students' documents reviewed

It was clear from the findings of students' exercises and homework books that, students with visual impairment in Ghana National and St. Joseph Basic Schools performance in mathematics was lower. This was evident when fifteen students which was the highest number of the students, representing 30.6 % scored 35-39 marks and falls within the lower range. Ten students which was the second highest number of the students representing 20.4% scored 40-49 marks and falls within the low range. In the same way, nine students which is the third highest population of then students representing 18.4% scored 50-54 marks and are recorded with the low average range. Beyond doubt, findings from the students with visual impairments exercises and homework books revealed that four students which is the fourth highest of the students' number, representing 8.2% scored 55-59 marks and were recorded within the average range. Also, two students which is the fifth highest of the students' number, representing 4.1% scored 70-79 marks and were within the high range.

Followed by one students which was the sixth highest of the number of the students in terms of the students' performance in mathematics at Ghana National Basic and St. Joseph Basic Schools, Ghana representing 2.1% scored 60-69 marks and falls within the high average range. Finally, none of the students scored 70-79 marks or 80-100 marks.

In addition, it was clear from the findings of students' exercises and homework books that, majority of the students (74.4%) and (67.3) performance in multiplication and division of numbers was lowest whiles few of the students (10.2%) and (20.4%) performance in subtraction and addition of numbers respectively was lowest. This confirms Sheila, Hong and Rosenblum (2013) study which revealed that, when students with visual impairments were provided with instruction in abacus computation, the most frequently taught skills were the operations of addition and subtraction because the students get addition and subtraction skills easier than multiplication skills. Kaufmann (2010) added that, students failed when they had to relate multiplication to a context. This implies that although students with visual impairment performance in mathematics is low. However, students with visual impairment can perform better in addition and subtraction operations as compare to multiplication and division.

Finally, findings from students' terminal report cards revealed similar results from student's exercises and homework books. This was evident when twenty students representing 33.3% scored 40-49 marks from their terminal report cards and are recorded with the low range whiles fifteen students, representing 25.5% scored 0-34 marks from their terminal report cards and were within the lowest range. Again, twelve students representing 20% scored 35-39 marks from their terminal report cards and were within the lower range. Furthermore, six students representing 10% scored

50-54 marks and are recorded with the low average range. Additionally, five students representing 8.3% scored 60-69 marks from their terminal report cards and are recorded within the high average range and two students representing 3% scored 55-59 marks and are recorded within the average range. None of the students scored 70-79 marks, 80-89marks and 90-100 marks. This implied that students with visual impartment performance in mathematics was low. This is because the highest percentage of the students' number representing 33.3% scored 40-49 marks from their terminal report cards. These confirms Megan (2012) study which found that, students with visual impairment may not do well in mathematics because it is a subject that mostly require the use of vision considering the language of mathematics such as directions, quantity and shape. The findings in other hand do not support the study of Lynn (2012) which reported that, on the performance assessment in mathematics among students with visual impairments, the level of performance of students with visual impairment in mathematics was encouraging.

5.2 Research Question 2: What factors influence the performance of students with visual impairments in mathematics at Ghana National Basic and St. Joseph Basic Schools in Ghana?

Teacher-related factors

From the findings of students, teacher-related factors regarding the factors that influence students with visual impairment performance in mathematics were factors. This was evidence when teachers' attitudes and beliefs on students' performance in mathematics, teachers' qualification on students' performance, teachers' instructional methods, teachers' knowledge about students with visual impairments, and pedagogical content knowledge teachers have in teaching mathematics to students with visual impairments recorded mean scores of (M=4.03, SD=.938), (M=3.17,

SD=1.553), (M=1.86, SD=1.117), (M=1.72, SD=.904) (M=1.87, SD=1.112), respectively.

Beyond doubt, interview of the teachers further supported the same assertion that, teachers' beliefs about students with visual impairment and mathematics, knowledge teachers have about students with visual impairment and instructional method negatively influence the performance of students with visual impairment in mathematics at Ghana National and St. Joseph Basic Schools. This implies that, the respondents believe that, teacher-related factors have negative influence on students with visual impairments performances in mathematics. This further implies that the low performance in mathematics among students with visual impairments at Ghana National and St. Joseph Basic Schools in Ghana was as a result of teacher-related factors. These were in accordance with Waihenya (2000) study which found that, students normally blame their teachers for poor performance in mathematics and sciences subjects. This is because teachers always concentrate on the few students they have recognized as good in the subject mathematics whiles putting off those who are weak in mathematics. This attitude of teachers has been one of the factors influencing students' performance in mathematics (Waihenya, 2000). Sila (2014) study also found that, the problem of poor mathematics performance lies with the instructor, training process, ability to adapt to changes in curriculum and lack of opportunity for skill improvement. Shiundu 1992) stated that, adequate qualification of the teacher instills self confidence in the teacher and serves as an inspiration to students while teachers without proper academic and professional qualifications fail to do justice to the students. Teachers' knowledge of mathematics content and pedagogy is also critical to the culture of the learning environment (Koehler, *et al*., 2013).

Student-related factors

Findings from students, regarding student-related factors indicated that, students' attitudes towards mathematics (M=4.03, SD=.938) are factors that have influence on students with visual impairments performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. These implied that, the students agreed to the fact that, they do not enjoy learning in mathematics class, they have not developed confidence in mathematics class. However, the respondents affirmed to the fact that, they are happy for the mathematics skills they have gained and understand mathematics when they discover new method of solving them.

Furthermore, the students with visual impairment were in support that mathematics should be taken from the syllabus because mathematics is difficult for them to study. As a result of that, some of the students' responses that they do absent myself from mathematics class. This result is in line to the findings from a study conducted by Costello (1991) which indicated that students formed different attitudes towards mathematics because some described mathematics as hard or difficult. It could be noted therefore that, negative attitude of students with visual impairment towards mathematics at Ghana National and St. Joseph Basic Schools in Ghana is one of the factors of the students' low performance in mathematics. These findings supported a study conducted by Mokgaetsi (2009) that, negative side of the student's attitude may cause low performance among the students in mathematics, preventing them from obtaining necessary result from further study. This is because continual low performance in mathematics might lead to negative attitudes towards the subject which in turn may influence how a student with visual impairment will learn the subject mathematics in the subsequent years of education (Jackson, 2010). Teachers'

interview revealed the same results that, students with visual impairment show negative attitude towards mathematics subject.

Concerning, peer support and performances in mathematics, respondents agreed that, they receive support from their colleagues during mathematics lesson (M=4.50, SD=.873. The students further agreed that, they can share new ideas during mathematics discussions with their peers. This finding is contrary to that of Oloo et al. (2016) which revealed that, peer support builds the confidence in the students and allows them to interact and share ideas. Again, some of the students felt that they solve mathematics problem better when their peers support them. Teachers' interview revealed the same results that, students with visual impairment receive support from their sighted peers in mathematics subject at Ghana National and St. Joseph Basic Schools, Ghana. It could be noted therefore that, low performance of students with visual impairment at Ghana National Basic and St. Joseph Basic Schools cannot be contributed to peer support. Oloo et al. (2016) in his study, explained that students performed significantly better in peer teaching and group discussion.

School-related factors

The analysis of the data collected from the students revealed elements that show the extent to which students with visual impairments performance in mathematics is been influenced by some school-related factors. From the analysis of the data, it was obvious from the respondent that, class size affect learning of mathematics among student with visual impairment (M=4.17, SD=1.028). This was consistent with Kibui (1995) which posited that if students are crowded in their sitting positions because of the size of the classroom; they find it difficult to write in their books and teachers are also unable to move round the crowded class. A study of Maria and Vincenzo (2013) on class size effect on students' achievement:

heterogeneity across abilities and fields also revealed that larger classes have a significant and sizeable negative effect on student performance in mathematics. Agran, Alper and Wehmeyer (2002) are of the view that, large classes may be viewed as an obstacle to the academic performance of students with visual impairments.

Findings of the students with visual impairment on large class further revealed that, educational materials are not enough for student with visual impairment during mathematics lesson because of large class (M=4.60, SD=.494). This confirmed Krueger et al. (2001) research which indicated that, large class size affect educational materials because there may not be enough for the number of students in a particular class. In the large class, discussion time becomes fragmented among students and instructors may rely on passive lecturing, assign less written homework or fewer problem sets, and may not require written papers (McKeachie, 1990). Responses of the teachers revealed similar result that, large class size negatively influence the performance of students with visual impairment in mathematics. For instance, a teacher in one of the schools commented that the students are many so attending to them one after the other makes the work difficult. Also, the resources available are not enough due to the large class size.

The analysis of the data collected from the teachers on the nature of mathematics curriculum remarked that, the mathematics curriculum is broad for students with visual impairments to study. This confirmed Mazana et al. (2019) research which indicated that mathematics curriculum is very long, hence, teachers fail to complete the syllabus. However, it was emerged from the study of Maguvhe (2015) that the mathematics curriculum is not broad and it is accessible to the learners who are blind and partially sighted because learners who are blind and partially sighted have the same mental capacity to comprehend mathematics and science.

Maguvhe added that, it is the teachers themselves who make the mathematics curriculum inaccessible because they do not believe in the students with visual impairments.

Another aspect that was looked at was availability of teaching and learning resources on students' performance in mathematics. Majority of the student disagreed that, there are available resources such as textbooks, abacus, talking calculators, computers, and braille materials in the schools (M=1.58, SD=.497). These implied that, students with visual impairment low performance in mathematics at Ghana National and St. Joseph Basic Schools can be contributed to availability of teaching and learning resources in the schools. For instance, Maguvhe (2015) study mentioned that lack of resources, maps and tables are some of the setback's students with visual impairments encounter when doing or want to do mathematics and science. Study conducted by Maltese (2006) on teaching mathematics to blind students, the study revealed that lack of resources lead teachers and the learners to automatically skip certain mathematical tasks stated in the syllabus which can affect the performance of their students.

Concerning environmental noise as school-related factor that influence student with visual impairment performance in mathematics, majority of students agreed that, the school environment is noisy for learning mathematics (=4.48, SD=.504). This make them get distracted during mathematics lesson (M=4.58, SD=.497). Again, the results of the teacher's interview revealed similar opinions regarding environmental noise in the schools. These implied that, environmental noise was a factor of students with visual impairment low performance in mathematics at Ghana National and St. Joseph Basic Schools, Ghana. This result, supports Bridget (2003) whose result revealed from a study they conducted that, it is generally accepted that noise has a

detrimental effect upon learning, therefore, tasks that involve language and mathematics demands attention, since they have high cognitive processing. Mazana, et al. (2019) also added that noise hinder students' understanding of mathematics and consequently affected their performance.

In summary, it was observed from the student' responses and teacher's interview that, teacher-related factors, student-related factors and school-related factors were factors which contributed to the low performance of students with visual impairment in mathematics at Ghana National and St. Joseph Basic Schools in Ghana.

5.3 Research Question 3: What strategies could be adopted to improve on the performance in mathematics by students with visual impairments in Ghana National Basic School and St. Joseph Basic Schools in Ghana?

From the findings of students, regarding the strategies that could be adopt to improve on students with visual impairment performance in mathematics, forty-two students out of the sixty students representing 85.7% suggested that recruitment of more qualified mathematics teachers by government is one of the strategies that can be adopt to improve students with visual impairment performance in mathematics at Ghana National Basic and St. Joseph Basic Schools in Ghana. This confirmed Mwangi (2014) research which indicated that teacher's qualities and qualifications are very significant in performance of mathematics and these qualities will lead to good performance. Mwangi added that, teachers of students with visual impairments should be teachers who possessed qualities that will enable the teachers to teach mathematics to their students in the simplest and most effective ways. Bell (1998) also indicated that qualified and experienced teacher produces high academic performance than the untrained teacher. Having a teacher who teaches for understanding, makes lessons

enjoyable, a kind person and tolerant, is of crucial importance for students' engagement in mathematics (Mazana et al., 2019). This result shows the importance of the teachers' personal and professional characteristics in students' performance in mathematics. Therefore, teachers should open for some characteristics that will help students develop a positive attitude towards the subject.

From the findings, peer tutor emerged as one key strategy needed to improve students with visual impairments' performance in mathematics. This was evident when 81.6% of the students suggested that students with visual impairment in Ghana National and St. Joseph Basic Schools performance in mathematics could be improve when student are supported by their sighted peers. Result of the teachers revealed that the use of peer tutors during mathematics lesson is important strategy which should be encourage. During teaching, teachers should use sighted students as peer tutors to help students with visual impairments or students with visual impairments who understood the concept as peers to help their colleagues with visual impairments. According to the findings, since the students understood each other better, it would be better for a teacher to use peer tutors to help students with visual impairment take part in mathematics activities which can lead to promoting the student level of involvement. Nurmi, Hirvensalo and Klemola (2013) also conducted a study whose results revealed that peer tutoring is important because it helps students to take part actively in tasks and promote their level of involvement. Similarly, findings from a study conducted by Block (2007) also revealed that peer tutor is important because it help children with special needs and their non-disabled peers to effectively interact in the classroom.

Again, findings of students revealed that resource teachers' support can improve students with visual impairments performance in mathematics. The analysis of the data collected from the teachers on strategies that could be adopted to improve

students with visual impairment performance supported the findings of the students. This therefore meant that resource teachers' support is very important strategy needed to improve students with visual impairment performance in mathematics at Ghana National Basic and St. Joseph Basic Schools, Ghana. These confirmed Baine (2001) research which indicated that, resource teachers are important in improving mathematics performance of students with visual impairment because resource teachers provide in-service training for the other teachers on how to manage the students with visual impairment in learning. Baine added that resource teachers help students with visual impairment to adjust in the general education which may help them benefit from their education.

Furthermore, this present study revealed that parental support is a strategy that could be adopted to improve students with visual impairment performance in mathematics at Ghana National and St. Joseph Basic Schools in Ghana. This was evident when 30.6% of the student made suggestion that parents of students with visual impairment should motivation their children who are visually impaired to study mathematics as their siblings who are not visually impaired. This meant that students with visual impairment lack motivational support from their parent as compare to their sibling who are sighted at Ghana National Basic and St. Joseph basic school, Ghana. This confirmed Costello (1991) study which revealed that parents should deliberately attempt to treat their children equally, make unbiased comments regarding learning of mathematics and avail equal opportunities to their children to pursue mathematics.

To add to, result of the teachers' interview revealed that parents and the society should encourage students with visual impairment to develop good attitude towards mathematics. This could therefore be observed that, in other to improve

student with visual impairment performance in mathematics parental support should be adopt as a strategy to improve students with visual impairment performance in mathematics at Ghana National Basic and St. Joseph Basic Schools in Ghana. This present study confirmed Costello (1991) study which revealed that mathematics should be viewed by the general public with a more positive attitude because the students with visual impairments are first in the society before they are in school, they unconsciously form attitudes whether positive or negative towards mathematics and towards anyone who teaches mathematics.

Also, the findings of the teachers revealed that, verbal description of instructions is another strategy that could be adopt or use to improve on the performance of students with visual impairments in mathematics. This shows that if students with visual impairments performance in mathematics could be improve at Ghana National and St. Joseph Basic Schools, teachers or instructors must use verbal descriptions as one of the strategies to help students grasp concepts easily. Every single thing which will done during mathematics activities must be verbally describe for students to follow and imitate. In line with this, Garaj, Jirawimut, Ptasinski, Cecelja, and Balachandran (2003) opined that, students with visual impairments must always be provided with detailed verbal descriptions of cues when they are in a very complex environment. Findings from a study conducted by Miner et al. (2001) also revealed that in teaching the students who with visual impairment, charts, diagrams, graphs, and other information being presented in a visual format must be explained and described verbally.

From the findings, it was emerged from the teacher's interview that students should show positive attitude towards homework. According to the teachers, most of the students fail to do their homework or assignments. Parents should therefore

encourage their children to do their homework because homework helps the students to develop mathematics skills and increases the understanding of the student. These findings are in line with Grouws (2001) who stated that the purpose of homework includes developing skills, increasing understanding, demonstrating application, and developing connection.

In addition, findings of the teachers revealed that teacher in-service training was a strategy that could be adopted to improve student with visual impairments performance in mathematics. According to the teachers, teachers need to attend in-service training regularly on how to teach mathematics to students with visual impairment. This finding is in line with Maguvhe (2015) who conducted a study on teaching science and mathematics to students with visual impairments: The study revealed that mathematics and science teachers who teach mathematics to students with visual impairments need to attend regular staff development workshops covering selected topics in mathematics, science and accommodation suitable for learners who are blind and partially sighted.

The findings further revealed that for students with visual impairment performance to be improve, teachers' needs in-service training in order to keep to the demands of the students with visual impairment in an inclusive classroom. Maguvhe (2015) stated that teachers who teach mathematics to students with visual impairments need to be inspired to attend workshops to enable them keep abreast to curriculum demands, new developments in their subject areas and emerging technologies for accommodating their learners' educational and wellness needs. Moreover, findings of the students revealed that adaption of mathematics material was another strategy that can improve the performance of students with visual impairment. This implied that teachers must adapt mathematics materials when teaching

mathematics to students with visual impairment in Ghana National and St. Joseph Basic Schools in Ghana so that they can participate effectively in mathematics class. This present study confirmed (Asempa, 2013) study which revealed that teachers should be provided opportunities for in-service training so they can acquire requisite skills in adapting the national curriculum to enable pupils with disabilities to participate effectively in teaching and learning process. Kelly, Ajuwon, and Wolffe (2015) study also revealed that, lack of adapted equipment was one of the challenges students with visual impairments face in participating in recreation and teaching activities. Petrie, Power and Swallow, (2009) said provision of adaptations to students with disabilities promote equal opportunities and avoid discrimination.

However, from the teachers comments it was clear that, teachers need to adapt their instructions when they are teaching mathematics to student with visual impairment in order create opportunity for the students to participate in mathematics lesson. Again, it was noted from the comment that teachers must adapt instruction base on the interest of the student for their participation. Findings from a study conducted by Koeze (2007) in Michigan support this present study that, differentiated instructional strategies of choice and interest played a very important role in achievement and student satisfaction in learning. Meanwhile, another finding from the same study also showed that adapted instructions were very necessary for the competence domain of students with learning disabilities for their effective inclusion into the regular classroom.

The final strategy that was revealed during data analysis was group work. According to the students when students are put in a group for mathematics lesson, they feel free to discuss their problems among themselves and work together to solve

the issues. In line with this, Williamson (2006) stated that, group work increased the opportunities for communication and made problem solving a richer experience for students. She added that, students felt isolated and frustrated when they were asked to work by myself but showed confident and felt less frustrated with the material when they were asked work as a group. This present study also supported Panitz (2000) study, which revealed that a student responded to her interviewed question by saying, "Before your class, I disliked mathematics. I was always getting aggravated and scared by it. Working together with those around me in a group was a great help in understanding the material and many different ways in which a problem can be tackled and solved".

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

The purpose of the study was to explore the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana. It specifically sought to:

1. Find out the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana.
2. Identify factors which influence the performance in mathematics of students with visual impairments in Ghana National and St. Joseph Basic Schools in Ghana.
3. Recommend strategies that could be adopted to improve the performance of students with visual impairments in mathematics in Ghana National and St. Joseph Basic Schools in Ghana.

Three research questions were developed to guide the study. Theory of Performance by Don Elger was adopted to guide the study. The study employed mixed method approach with sequential explanatory design. A Likert scale type questionnaire was used to collect the data from 60 students with visual impairments and 2 mathematics teachers. Data from the questionnaire was analyzed via Statistical Product and Service Solutions (SPSS) version 21.0, to generate the percentages, mean and standard deviation, while data from the interviews were analysed using themes that emerged from the responses of the respondents.

6.1 Summary of Major Findings

The major findings are summarized below:

6.1.1 Performance of students with visual impairments in mathematics

It was clear from the findings from students' exercises and homework books that, students with visual impairment in Ghana National and St. Joseph Basic Schools performance in mathematics is lower. This was evidence when fifteen students which was the highest population of the students, representing 30.6 % scored 35-39 marks and were within the lower range.

Additionally, findings from students' terminal report cards revealed similar results from student's exercises and homework books. This was evident when 33.3% representing the majority of the students number scored 40-49 marks from their terminal report cards and falls within the low range whiles fifteen students, representing 25.1% scored 0-34 marks from their terminal report cards and were within the lowest range.

6.1.2 Factors that influence students with visual impairment performance in mathematics

6.1.2.1 Teacher-related factors

From the findings of students, teacher-related factors regarding the factors that influence students with visual impairment performance in mathematics were factors. This was evidence when teacher's attitudes and beliefs on students' performance in mathematics, teachers' qualification on students' performance, instructional methods, teachers' knowledge about students with visual impairments, and pedagogical content knowledge teachers have in teaching mathematics to students with visual impairments recorded mean scores of (M=4.03, SD=.938), (M=3.17, SD=1.553), (M=1.86,

SD=1.117), (M=1.72, SD=.904) (M=1.87, SD=1.112), respectively. Beyond doubt, interview of the teachers further supported the same assertion that, teachers' belief about students with visual impairments and mathematics, knowledge teachers have about students with visual impairment and teachers' instructional method were factors contributed to the low performance of students with visual impairment in mathematics at Ghana National Basic and St. Joseph Basic School.

6.1.2.2 Student-related factors

Findings from students, regarding student-related factors indicated that, students show negative attitudes towards mathematics (M=4.03, SD=.938). Teachers' interview revealed the same results of that of the students concerning students' attitude towards mathematics. This implied that the low performance of students with visual impairment in mathematics at Ghana National and St. Joseph Basic Schools in Ghana can be contributed to students with visual impairment negative attitude towards mathematics. However, concerning peer supper, the students agreed that they receive support from their colleagues during mathematics lesson (M=4.50, SD=.873). This implied that students with visual impairment low performance in mathematics at Ghana National and St. Joseph Basic Schools cannot be contributed peer support. Teachers' interview revealed the same results that, students with visual impairment receive support from their sighted peers in mathematics subject.

6.1.2.3 School-related factors

The analysis of the data collected from the students revealed elements that show the extent to which students with visual impairments performance in mathematics is been influenced by some school-related factors. From the analysis of

the data, it was obvious from the respondent that, class size affect learning of mathematics among student with visual impairment.

Findings of the students with visual impairment on large class further revealed that, educational materials are not enough for student with visual impairment during mathematics lesson because of large class. Responses of the teachers revealed similar result that, large class size was the cause of students with visual impairment low performance in mathematics. For instance, a teacher in one of the schools commented that the students are many so attending to them one after the other makes the work difficult. Also, the resources available are not enough due to the large class size.

Again, the analysis of the data collected from the teachers on the nature of mathematics curriculum remarked that, the low performance of the students with visual impairment was that, mathematics curriculum is broad for students with visual impairments to study.

Another aspect that was looked at was availability of teaching and learning resources on students' performance in mathematics. Majority of the student disagreed that, there are available resources such as textbooks, abacus, talking calculators, computers, and braille materials in the schools. These implied that, students with visual impairment low performance in mathematics at Ghana National and St. Joseph basic school cannot be contributed to availability of teaching and learning resources in the schools.

Concerning environmental noise as school-related factor that influence student with visual impairment performance in mathematics, majority of students agreed that, the school environment is noisy for learning mathematics. The results of the teachers' interview revealed similar opinions regarding environmental noise in the schools. These implied that, environmental noise was a factor of students with visual

impairments low performance in mathematics at Ghana national and St. Joseph basic schools, Ghana.

In summary, it was observed from the student' responses and teachers' interview that, teacher-related factors, student-related factors and school-related factors were factors which contributed to the low performance of students with visual impairment performance in mathematics at Ghana National and St. Joseph basic schools, Ghana.

6.1.3 Strategies that can be adopted to improve students with visual impairment performance in mathematics

From the findings of students, regarding the strategies that could be adopted to improve on students with visual impairment performance in mathematics, 85.7% suggested that recruitment of more qualified mathematics teachers by government is one of the strategies that can be adopt to improve students with visual impairment performance in mathematics.

Again, from the findings, peer tutor emerged as one key strategy needed to improve students with visual impairments performance in mathematics. This was evident when 81.6% of the students suggested that students with visual impairment in Ghana National and St. Joseph basic school performance in mathematics could be improve when student are supported by their sighted peers. According to the teachers' findings, since the students understood each other better, it will be better for a teacher to use peer tutors to help students with visual impairment take part in mathematics activities which can lead to promoting the student level of involvement.

Also, findings of students revealed that resource teachers' support can improve students with visual impairments performance in mathematics. The analysis of the data collected from the teachers on strategies that could be adopted to improve students with visual impairment performance supported the findings of the students. This therefore meant that resource teachers' support is very important strategy needed to improve students with visual impairment performance in mathematics at Ghana National Basic and St. Joseph Basic schools, Ghana.

Furthermore, this present study revealed that parental support is a strategy that could be adopted to improve students with visual impairment performance in mathematics at Ghana National basic and St. Joseph basic school, Ghana. To add to, result of the teachers' interviews revealed that parents and the society should encourage students with visual impairment to develop good attitude towards mathematics in other to improve student with visual impairment performance in mathematics.

Moreover, the findings of the teachers revealed that, verbal description of instructions is another strategy that could be adopted or use to improve on the performance of students with visual impairments in mathematics. From the findings, it was emerged from the teachers' interviews that students should show positive attitude towards homework. According to the teachers most of the student fail to do their homework or assignments. Parents should therefore encourage their children to do their homework because homework helps the students to develop mathematics skills and increases the understanding of the student.

The final strategy that was revealed during data analysis was the teachers' in-service training. According to the teachers, teachers need to attend in-service training regularly on how to teach mathematics to students with visual impairment. Teacher's findings further revealed that for students with visual impairment performance to be improve teachers' needs in-service training to keep to the demands of the students with visual impairment in an inclusive classroom.

6.2 Conclusion

The study concluded that students with visual impairments performance in mathematics is low. However, factors such as teacher-related factors, student-related factors and school-related factors were factors that contributed to the low performance of the student with visual impairment. Yet there were some strategies such as recruitment of qualified mathematics teachers, use of peer tutor, societal and parental support, resource teachers support, verbal description of instruction and teacher in-service training as strategies that could be adopt to improve students with visual impairment performance in mathematics.

6.3 Recommendations

These recommendations were made based on the findings of this study:

- The Ghana Education Service (GES) in collaboration with school heads should organize an in-service training seminars or workshop for the regular education teachers on how to teach mathematics to students with visual impairment.
- The government should recruit resource teachers who have knowledge on mathematics to support students with visual impairment in the basic schools.

- The government as well as the heads of schools should improve on the numbers of teaching and learning resource to promote the performance of students with visual impairment in mathematics.
- The school authorities should make sure that class size is reduce for effective teaching thereby improving the performance of students with visual impairment in mathematics.
- The government in collaboration with Ghana Education Service (GES) should design the mathematics curriculum to suit student with visual impairment

6.4 Suggestions for Future Research

The current research was based on the performance of students with visual impairments in mathematics in the selected two basic schools, in Ghana

It is suggested that future studies should be conducted in the areas discussed below:

- Need for a study that compares the performance of students with visual impairment in mathematics with their sighted peers.
- Need for further research to investigate the performance of students with visual impairments in mathematics in the secondary schools, Ghana.

6.5 Contribution to Knowledge

This present study contributed to knowledge. This is because very little research in Ghana was available to the researcher on the performance of students with visual impairments in mathematics. The study provides an in-depth insight into the extent to which students with visual impairments performance is low or high in Ghana. Secondly, the study highlighted the various factors that influence the performance of students with impairment. Again, the study also showed that different strategies could be used to improve student with visual impairment performance in

mathematics. Finally, this study offers support to already existing research findings on the variables that contribute to students with visual impairments performance in mathematics and goes a step further to provide information specifically on Ghanaian students with visual impairments.

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APPENDICES

APPENDIX A

Questionnaire for Students with Visual Impairments

A study is being carried out to establish the performance of students with visual impairments in mathematics in two basic schools, St. Joseph Basic School, Bechem and Ghana National Basic School, Cape Coast. You have been identified to participate in the study as a respondent. Please fill in the questionnaire as accurately as you can by ticking or filling in appropriately. This is purely an academic exercise and the information you provide will be treated in strict confidence.

PART "A" Demographic data

(a) What is your age (years)

13-20 [ ]

Above 20 [ ]

(b) Your sex. Male [ ] Female [ ]

(c) Degree of impairment. Low vision [ ] Blindness [ ]

PART B

Factors that influence the performance of students with visual impairments in mathematics

Instructions: Please indicate by ticking (√) the extent to which you disagree or agree with the statements concerning the factors that influence the performance of students with visual impairments in mathematics. Scoring Rubric: Strongly Disagree (SD) = 1; Disagree (D) = 2; Agree (A) = 3 Strongly Agree (SA) =4

N/S	TEACHERS-RELATED FACTORS	SA	A	D	SD
	Teachers attitude and belief on students' performance in mathematics				
1.	My mathematics teacher frequently absent himself from class during mathematics class or lesson				
2.	My mathematics teacher come to class late during mathematics lesson or class?				
3.	My mathematics teacher encourages me to pursue higher level in mathematics education?				
4.	My mathematics teacher belief that mathematics is difficult for me to understand				
	Pedagogical content knowledge teachers have in teaching mathematics to students with visual impairments.				
5.	I get inspire during mathematics lesson				
6.	My mathematics teacher deliver mathematics content to my understanding				
	Teachers' instructional methods influencing performance in mathematics				

7.	My mathematics teacher revise previous lesson with us during mathematics lesson?				
8.	I understand the language my mathematics teacher uses during mathematics lesson?				
9.	My mathematics teacher put us in groups during mathematics lesson?				
Teacher's knowledge about students with visual impairment and performance in mathematics					
10	My mathematics teacher beliefs that students with visual impairment can learning mathematics?				
11	My teacher spell out what he writes on the chalkboard?				
12	My mathematics teacher speak clearly in a normal voice during mathematics class or lesson				
Teacher's qualification and students' performance in mathematics					
13	My mathematics teacher put the blame on me if I did not understand mathematics concept				
14	My mathematics teacher always make sure that the classroom is well organized during mathematics lesson				
STUDENT-RELATED FACTORS					
Students attitude and performance in mathematics					
15	I enjoy learning in mathematics class?				
16	I have developed confidence in mathematics?				
17	I am happy for the mathematics skills that I have gained?				
18	I understand mathematics concept well when I discover new methods of solving them on my own?				
19	I do absent myself from mathematics class				
20	I wish mathematics should be taken from the syllabus?				
Peer support and performance in mathematics					
21	I receive support from my colleague students in mathematics lesson?				
22	I am able to share new ideas during mathematics discussions with my peers?				
23	I understand better when I solve mathematics problems in class with my peers supporting me?				
24	My friends encourage me to learn mathematics?				
SCHOOL-RELATED FACTORS					
Class size effect on students' performance in mathematics					
25	I found it difficult to understand mathematics concept during mathematics class because of the large class size?				
26	Educational materials are not enough for us during mathematics lesson because of the large class size?				
27	I do not get the attention of the teacher because of large class size				
Availability of teaching and learning resources on students' performance in					

	mathematics				
28	There are available resources such text books, abacus, talking calculators, computers, and braille materials in the schools?				
29	I have no interest in mathematics because of lack/inadequate of mathematics materials such as textbooks, abacus, talking calculators, computers, braille materials?				
	Environment noise				
30	The school environment is noisy for learning mathematics?				
31	The noise in the school distract our attention during mathematics lesson?				
32	I found it difficult to hear the voice of the teacher during mathematics lesson because of the noise in the school?				

PART C

32. In your opinion, list at least 3 strategies that could be adopt to improve your learning of mathematics

……

……

……

……

APPENDIX B

Teacher's Interview Guides

Factors that influence students with visual impairments performance in mathematics

1. **Teacher-related factors**

   Describe how teacher-related factors influence students with visual impairment performance in mathematics

Prompts:

a. What is your level of qualification in teaching mathematics?
b. What are your beliefs in teaching mathematics to students with visual impairment?
c. How are you able to deliver mathematics lessons to students with visual impairments to meet their understanding?
d. How do you apply your knowledge about students with visual impairment in teaching mathematics to them?

2. **Student-related factors**

   Describe how students related factors influence the students with visual impairment performance in mathematics

Prompts:

a. How is the attitude of students with visual impairment towards mathematics?
b. What support/s does the students with visual impairment received from their peers who are sighted?

3. **School-related factors**

   Describe how students related factors influence the students with visual impairment performance in mathematics

Prompts:

a. How do you get resources to teach students with visual impairment mathematics?

b. How does resources limit you from teaching mathematics to students with visual impairment?

c. What do you have to say about large class size and how it affect students with visual impairments performance in mathematics?

d. What is your view about the mathematics curriculum and students with visual impairment?

e. How do you adjust instruction during teaching and learning in relation to class size?

f. How does the environmental noise in the school influence student with visual impairment performance in mathematics?

Strategies that could be adopt to improve students with visual impairments performance in mathematics

1. What strategies do you think could be adopt to improve student with visual impairment performance in mathematics?

APPENDIX C

Letter of Introduction

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF EDUCATIONAL STUDIES
DEPARTMENT OF SPECIAL EDUCATION
P. O. Box 25, Winneba, Ghana
sped@uew.edu.gh
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April 8, 2019

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.....

.....

.....

Dear Sir/Madam,

LETTER OF INTRODUCTION

I write to introduce to you Mr. Emmanuel Agyei an M.Phil student of the Department of Special Education of the University of Education, Winneba, with registration number 8170150007.

He is currently working on his thesis on the topic: ***"Performance of Students with Visual Impairment in Mathematics in two Basic Schools, Ghana".***

I should be grateful if you could give him the needed assistance to enable him carry out his studies.

Thank you.

Yours faithfully,

DR. DANIEL S. Q. DOGBE
Ag. Head of Department