TACTILE MATERIALS AS CORRELATES OF PERFORMANCE IN MATHEMATICS AMONG LEARNERS IN THIKA HIGH SCHOOL FOR THE BLIND, KIAMBU COUNTY, KENYA

BY

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DECLARATION

I declare that this thesis is my original work and has not been presented in any other university/institution for consideration of any certification. This research thesis has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited using current APA system and in accordance with anti-plagiarism regulations.

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DEDICATION

To my beloved family, who through encouragement, gave me the strength to proceed on and my friends whose foresight in education and wisdom has brought me to this level of education.

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ABBREVIATIONS AND ACRONYMS

KCPE	Kenya Certificate of Primary Education
KNEC	Kenya National Examination Council
NIVH	National Institute for Visually Handicapped
SPSS	Statistical Package of Social Science
TB	Totally Blind
TGT	Tactile Graphic Tool
THSB	Thika High School for the Blind
VI	Visual Impairment

ABSTRACT

The purpose of the study was to assess the use of tactile materials as correlates of performance in Mathematics among learners in Thika High School for the Blind. The objectives were to: identify the tactile Mathematics materials used by teachers while teaching learners who are blind; explore the adequacy of the tactile teaching and learning materials; identify the challenges that teachers face in adapting Mathematic tactile teaching materials; investigate learners' perception on Mathematics tactile learning materials and investigate general performance of Mathematics among the learners who are blind. Two hypotheses were tested in this study. This study adopted social constructivism theory and used a case study research design. Target population was 85 respondents comprising 5 Mathematics teachers and 80 learners who are blind in the school. Purposive sampling technique was used to select Mathematics teachers while stratified random sampling was used to select the learners who are blind according to class and gender. Thereafter, simple random sampling was used to select 24 learners. Questionnaires were used to collect data. Pilot study was done at St Lucy School for the Blind to test validity and reliability of the research instruments. Quantitative data was collected, coded and organized. After analysis of data, the findings were presented in graphs, pie charts and bar graphs with the aid of Statistical Package of Social Sciences (SPSS version 20). The major findings were: available resources are inadequate and unsuitable to effectively assist learners' performance. Some teachers were not proficient in Braille Mathematics, thus a major hindrance for them to teach effectively. Many respondents recommended that the government should set aside more funds for Mathematic teaching and learning resources since their use in teaching was of uttermost importance. Therefore, this study recommends a need for the Ministry of Education to introduce AT courses in teacher training colleges. In addition, more time should be allocated in the school timetable for effective use of materials in teaching Mathematics to learners with visual impairment. Also, there is need for proper planning; preparation, presentation, appropriate application and essential follow up make the use tactile Mathematics materials ineffective by the teachers.

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

This chapter contains the background to the study, statement of the problem, purpose, objectives, hypothesis, significance, limitation and delimitations of the study, assumptions of the study. It further explains the theoretical and conceptual framework and operational definition of terms.

1.2 Background to the Study

Mathematics is important and an indispensable subject in human life. The utility of learning Mathematics is something phenomenal considering the application of Mathematics in one's life. Mathematics is used in all disciplines, therefore, one cannot do without it as it opens up career opportunities for learners (Wheeler, 2004). However, global trends especially in developing nations have shown that learners with Visual Impairment (VI) are hampered from realizing their full potential in careers and disciplines that are mathematically oriented. This is due to the nature of mathematical concepts that they acquire during teaching, learning and training (Maher & Martino, 1996).

In their study, Cobb, Wood, Yackel, Nicholls, Wheatley, Trigatti and Perlwitz (2006) identified the core areas of concern as fear and failure of Mathematics among learners with VI in the United States of America (USA). Performance of learners in an

examination reflects on their understanding of subject matter as taught and teachers' achievement of set objectives.

Brosnan (1997) carried out a study in France on factors contributing to learning of Mathematics among learners with visual impairment. The study identified that a good curriculum for learners with VI must possess carefully chosen objectives that stress a balance among cognitive, affective and psychomotor domain as part of the instructional strategies. It further recommended that key factors such as resources are considered important for effective learning of Mathematics by learners with VI. These factors included selecting and teaching of suitable mathematical Braille code. He also suggested for the adaptation of text materials and teaching on appropriate use of mathematical devices such as an abacus, talking calculators, protractor, compass and ruler. It provides the right of Mathematics text materials in preparation of appropriate teaching aids, stimulating experiences and creation of stimulating approach (Wheeler, 2004).

The Government of India through the National Institute for Visually Handicapped (NIVH) conducted human resource development program for special educators and resource teachers for schools for the blind whereby the title of the study was "Teaching Algebra and Geometry at Post primary level in December 2012" and a refresher course on "Teaching Arithmetic at Primary level in January to 1 February 2013" (Thamburaj & Nagar, 2010). It resulted in the development of a Tactile Graphic Tool (TGT) that enabled exploratory progress in making tactile diagrams of graphical and geometrical constructions. The portable digital gadget makes these accessible as digital pictures are interfaced in computer. This benefited people with VI to overcome constraints of

accessing graphic information in Mathematics, including graphs, geometry and statistical representations.

The case study's result represents a practical manifestation of the potential of Technology assisted learning for VIs (Thamburaj & Nagar, 2010).

In South Africa, Maguvhe (2015) conducted a study to investigate the teaching of Mathematics and Science to students who are blind and those with visual impairment. The case study drew on the experience of one blind male technician, who had great ambitions in the pursuit of science and technology, but with little support. The aim of the study was to understand the teaching and learning playing field. The focus was on what could be done to increase the involvement of visually impaired and halfway located students in Science and Mathematics training. The findings of the study indicated that the blind and partially sighted learners have the same mental capacity to comprehend Mathematics and Science. Maguvhe suggested that blind and partially sighted learners merely need to be appropriately accommodated to enable them to perform as well as their sighted counterparts in those sciences. Varieties of technologies are now available to allow for the participation of visually impaired and halfway located students in Science and Mathematics training.

A study conducted in Zambia by Ernest (1994) reveals that, although most schools in Zambia and East African region advocated for a policy in educating teachers, standard provision of materials and equipment to be made available. However, despite the policy, budget allotment was not adequate hence children with visual impairment cannot access

teaching materials and equipment as stated in the policies. He further stated that it was vital for advocacy and campaigning on adequate funding and provision of resources.

The key resources which were required in schools where the research was conducted included embossed maps, styluses and Braille materials (Ernest, 1994).

A research conducted by Sight Savers' International as reported by Munsanje (2011) showed that the educators were not all around prepared in the productive utilization of Mathematics material resources and that there was scarce instruction on how to use the resources therefore are unable to operate these devices to their upmost effectiveness. The outcome was that there was no proper use of the materials and resources (Munsanje, 2011).

In Kenya, education for learners with VI is twofold, integrated programs and residential schools. In both cases, Mathematics is a compulsory subject. Mathematics as a subject has proven to be a fundamental component in the overall grade since in any career course in addition to areas of interest; Mathematics grade attained is also assessed. Teachers indicate that Mathematics is very challenging to learners with visual impairment hence they perform poorly (Mwangi, 2014).

The Ministry of Education in Kenya made Mathematics a compulsory and examinable subject for all learners. Therefore, learning of Mathematics is not only important to learners who are sighted but also to the learners who are blind. Mwangi (2014) suggests that examinations in Kenya are very crucial to learners, parents and the nation, as each stage of education is a ladder to the next and a step to the development of a career.

However, Thuo (1999), notes most of learners with VI attend secondary schools while they continue to perform poorly in Mathematics due to inadequate resources.

Learners with VI depend on mental abilities rather than visual to make calculation easy to solve mathematical problems which comprise use of resource such as graphs, charts and tables. Some learners who are blind may have skills on abacus that help in solving mathematical problem mainly addition, subtraction, multiplication and division (Driscoll, 2005). Abacus does not provide options for mathematical calculations for generating pie charts, graphs and tables. Therefore, a learner who is blind is left with a task that they usually fill through mental calculation in solving such mathematical problem. The mental calculation is prone to errors and forgetting considering the mind and limitation to storing many calculations whereas at secondary school concepts are even more complex to be done mentally (Gachau, 2010).

The government of Kenya allows secondary schools to use scientific calculators in mathematical class (KNEC, 2005) which learners with VI cannot use because they are expensive, not readily available and they lack skills to use them thus learners with VI are disadvantaged.

Mathematics teachers who have trained in special education with specialization in Mathematics have best knowledge to teach mathematical concept to learners who are VI (Tinsley, 2007). have customarily been difficult to reach and testing to those showing students with visual impairment due to poor data and skills to instruct these changing

concepts. Disciplines that involve mathematical resources are life with visual presented concept and information which reveals that blindness restricts the variety of experiences. Therefore, loss of vision does not critically imply loss of opportunities for learning Mathematics concept. However, visual impairment can influence the educating of individual students, capacity and potential in Mathematics regardless of gender, social economic status age and race (Mohamed et al., 2010).

The information in the previous paragraphs concur with to Greeno (2003) there are many deficiencies in the way Mathematics is taught, this includes learners with VI hence need for this study as it creates knowledge based on the strategies to be considered on tactile teaching and learning resources on Mathematics performance among learners who are blind learners in Thika High School for the Blind.

1.3 Statement of the Problem

Mathematic resources are very essential in Mathematics teaching and learning. However, learners with visual impairment continue to perform poorly in Mathematics due to inadequate resources. In Africa, teachers are trained in the reading/writing of Mathematics Braille during their course. A study on education in East, Southern and Central Africa (ESCA) asserted that, despite the training offered in Mathematics subject methods, there is slight to no tailored training relating to Mathematics resources for learners who are totally blind hence, there is no emphases on new ideas and innovations to meet their needs which should be cheap and timely. A research that was done in Tanzania, Sierra Leone, Ghana and Nigeria highlighted that teachers had to have good

understanding of Mathematics Braille code and provision of relevant Mathematics Braille teaching resources.

Schools with scarce resources for learners who are blind can restrict access to gaining knowledge of numeracy, shapes, place value and other Mathematical concepts and hence experience barriers to the entire curriculum.

An earlier study on the factors influencing performance in Mathematics among learners with low vision in integrated public primary schools had clearly indicated that poor provision of materials and resources for Mathematics affected learning of learners with low vision and teaching. However, the concepts of Mathematics taught in primary school level is far much less complicated to the concepts taught in the secondary level. This is because learning becomes more and more involving and requires more practice. Therefore, this study sought to address the availability, use of tactile materials as correlates of performance in Mathematics among learners in Thika high school for the blind.

1.4 Purpose of the Study

This study aimed to establish availability, use of tactile materials as correlates of performance in Mathematics among learners in Thika High School for the Blind.

1.5 Specific Objectives

Specific objectives that guided the study were:

i) To identify the tactile Mathematics materials used by teachers while teaching learners who are blind in relation to performance in Mathematics.

ii) To explore the adequacy of the tactile teaching and learning materials in relation to Mathematics performance in Thika High School for the Blind.

iii) To identify the challenges that teachers face in adopting mathematic tactile teaching and learning materials.

iv) To investigate learners' perception on the mathematic tactile learning materials in relation to their performance in Mathematics.

v) To investigate general performance of mathematic among the learners who are blind.

1.6 Research Hypothesis

The following research hypotheses were used to guide the study:

H_{a1} There was a significant relationship between adequacy of tactile materials and performance in Mathematics among learners who are blind.

H_{a2} There was a significant relationship between learner's perception in the Mathematics tactile materials and performance in Mathematics.

1.7 Assumptions of the Study

i) The study assumed that there was a strong desire for learners to perform well in Mathematics

ii) Learners who are blind gave honest information regarding their teaching and learning experiences.

1.8 Limitations and Delimitation of the Study

1.8.1 Limitations

The study encountered the following limitation; first, this is a case study that specialized in only one school Thika School for the blind hence the findings cannot be fully generalized in Kenya.

Lack of literature to be reviewed since minimal study has been conducted in Kenya that focuses on pedagogical challenges of teaching learners with VI.

Lack of secondary schools in Kiambu County that have specialized in offering education to the visually impaired.

1.8.2 Delimitations

The research was conducted in Thika High School for the Blind, Thika West in Kiambu County, Kenya. The research focused on students with VI, Mathematics teachers and head teacher of Thika High School for the Blind. The research was restricted to tactile Mathematics teaching and learning materials. Sighted students were not studied because they were not the center of the study.

1.9 Significances of the Study

The findings may provide useful information to Ministry of Education, Special Education officials, policy makers and other stakeholders to formulate respective policies and set strategies in place that may elevate the performance of Mathematics of students who are visually impaired. The exploration discoveries may contribute to the better performance of students who are visually impaired.

The exploration discoveries may be of great help to the teachers of Mathematics in provision of quality teaching and learning resources. The study can also be an academic reference material

1.10 Theoretical and Conceptual Framework

The frameworks of the study were addressed in the following sub-section.

1.10.1 Theoretical Framework

This study adapted the theory of Social Constructivism by Vygotsky (1978) which is concerned with how appraisal should be used to augment both the student's learning and the teacher's understanding of student's progress. Constructivist model encourages the learners to actively participate in their own process of learning Mathematics with adequate Mathematics tactile teaching and learning resources for good performance while inadequate Mathematics tactile teaching and learning materials results to poor performance (Ormrod, 1995).

Constructivist classroom enable both teacher and learners think of knowledge as a dynamic, ever-changing view of the world. The learners therefore should have the ability to successfully stretch and explore, understand the content rather than memorizing (Ormrod, 1995: Owino, 2011). The key assumptions of this theory are that this study adopted that information is not passively accumulated, but rather, is the result of active cognizing by the individual hence this helps learners who are blind to be able to make their calculations in their minds better than their counterparts who are sighted; Cognition is an adaptive process that functions to make an individual's behavior more viable given a

particular environment; Cognition organizes and makes sense of one's experience, and is not a process to render an accurate representation of reality and Knowing has roots in both biological/neurological construction, social, cultural, and language based interactions. Constructing a meaning is an active and continuous process therefore learning may involve some conceptual changes (Owino, 2011).

Social constructivism theory emphasizes that, learners who are blind should be provided with adequate tactile Mathematics materials to explore and familiarize, creating way for questions that lead to more questions hence improve their Mathematics concepts. There is a lot of cover in social constructivist study hall, except for the more noteworthy accentuation set on learning through social collaboration, and the worth put on social foundation (Owino, 2011). For Vygotsky, culture gives the kid the psychological instruments required for improvement. This theory also notes that human beings have the ability to perceive real objects that have a sense and meaning beyond shapes that learners who are blind can understand and describe through external and internal speech in our environment (Owino, 2011).

Learners construct a new meaning using Mathematics tactile teaching and learning resources like: Braille Charts and Braille Graphs, Talking Calculators, Abacus, embossers, Measurement tools like rulers, Modified Instruments and equipment like collapsible cube and Tactile diagrams properly. Students use request techniques to pose inquiries, research a subject, and utilize an assortment of materials to discover arrangements and answers.

Instructors are relied upon to give an intuitively favorable condition to fruitful learning through direction and backing. Vygotsky argued that there is a moving target when the learners interact with materials to gain new knowledge in Mathematics. Vygotsky argues that teachers have a more elevated level of information than the students along these lines they give basic direction during the learning procedure. In this theory teachers are key who are required to provide initial guidance to learners so that they can develop new ideas in problem solving situation.

Basing on this theory interaction between the visually impaired learners and the teachers, availability and usage of Mathematics materials is pertinent to good performance in Mathematics. Teachers should be well trained to be able to understand how to guide learners who are blind to use the tactile Mathematics materials improve their performance.

1.10.2 Conceptual Framework

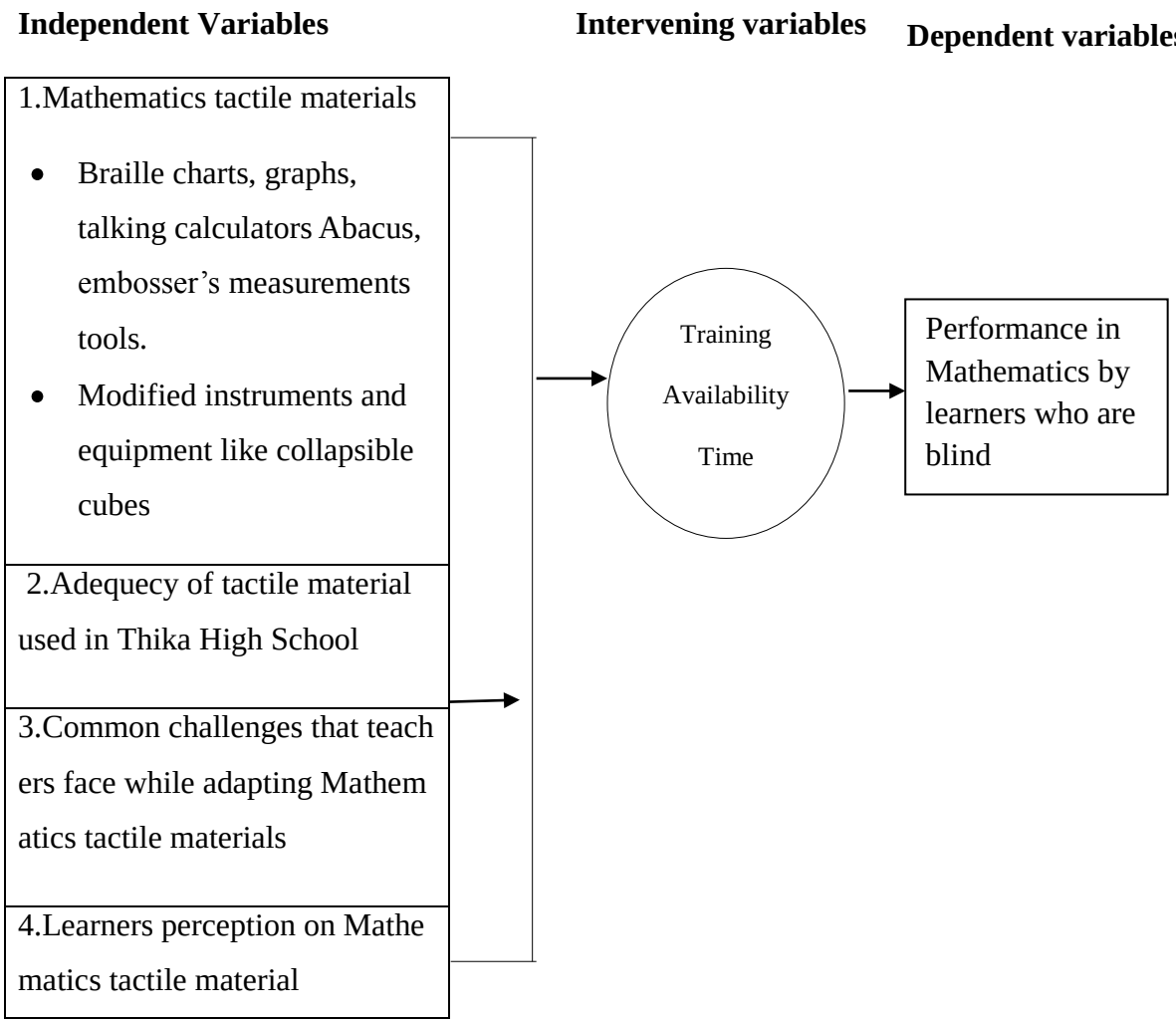

Figure 1.1: Relationship between Mathematics tactile materials and performance among learners who are blind

Source: Researcher's own model

The conceptual framework shows how the independent and intervening variables interacted to influence the dependent variable.

The independent variables included Mathematics tactile materials, challenges that teachers face while adapting Mathematics tactile materials and learners' perception on Mathematics tactile materials. The intervening variables include availability, time allocation and training teachers have in braille Mathematics while the dependent variable was the performance in Mathematics by learners who are blind.

1.11 Operational Definition of Terms

This are as follows:

Braille: A material composing framework, comprising of brought specks sorted out up in cells, utilized for reading and writing by persons who are visually impaired.

Braille note takers: Device that is used by individuals who are blind. It utilizes a progression of directions to deliver Braille since its input is through Perkins style. It has a speech synthesizer.

Cognitive ability: It is the mental action or process of acquiring knowledge and understanding through thought, experience and senses.

Mathematical materials: are resources that learners use to acquire a mathematical concept such as real objects, Textbooks and mathematical sets.

Braillewriter: A machine used to deliver embellished Braille images for tactual reading

Nemeth Code: A Braille code for Mathematics and logical documentation. It is generally utilized by students with visual hindrance.

Special Education: Area of education and social services provided to individuals with disabilities by educational institutions that deals with persons with special challenges.

Tactile teaching and learning resources include methods, learning aids and strategies to learn. There are many reliable tactile resources such as Talking calculators, Brailler.

Totally blind: are persons who use Braille as a medium of communication. They do not use vision although they may perceive light.

Visual impairment: A general concept all degrees of vision loss; and it includes blindness mild, severe and total loss.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter addresses the following subtitles as related by reviewed literature in this study: expected for learners who are blind, learning materials and teaching , adequacy of the learning materials and tactile teaching, challenges faced by teachers and learners in teaching the blind and adapting teaching and learning materials, perception of teachers and learners in teaching and learning Mathematics, general performance of learners who are summary of the literature review and visually blind in Mathematics

2.2 Teaching and Learning Materials Expected for Learners who are blind

The tactile materials which are often required for learners who are blind include the following:

Braille charts and graphs which involves the first ten letters of the alphabet, a–j, and use the upper four dot positions: These stand for the ten digits 0, 1 to 9 and a, b, c = 1, 2, 3 and to the three vowels in this part of the alphabet, a, e, i whereas the even digits, 4, 6, 8, 0 are corners/right angles. The next ten letters, k to t, are identical a-j respectively; apart from the addition of a dot at position 3. The investigation explored the existence and adequacy of this crucial teaching aid and the Derivation of the 26 letters of the alphabet from the 10 numeric digits (Nweke, 2004).

Talking calculators are intended for visually impaired and low vision clients just as second language students. They declare the numbers and count brings about an intelligible voice. Standard makes an increasingly specific model of the talking adding machine which delivers a tape. In addition, it checked on provision of talking calculators.

The abacus is a calculating tool. A bit of delicate texture or elastic is set behind the dots with the goal that they don't move unintentionally. This keeps the globules set up while the clients feel or control them. Students can utilize math device to perform division, mathematical functions multiplication, addition, square root, subtraction, and cubic root (Nweke, 2004). Moreover, it explored the existence and adequacy of these crucial teaching aids.

Braille embossers render text as Braille on uniquely thick paper or plastic. Used in conjunction with Braille translation software, embossers can print single-sided or double-sided Braille characters as well as Braille images (Nweke, 2004), and also it checked on availability of an embosser in the school.

Measurement tools are regularly important to gauge and attract edges the geometry homeroom. The most widely recognized gadget for estimating points is a protractor, generally in the state of a half circle. The half circle edge of the protractor is set apart with equitably dispersed divisions from 0o to 180o. Striking enormous print numbers and two Braille dabs are utilized to stamp degrees at 10o increases. Other gear might be named or checked tangibly for the accommodation of a visually impaired individual.

Dials might be set apart by making grooves with a scratch drill or dabs of dried paste or fingernail clean. Decorated chart sheets have Braille dab matrices on Manila paper. Decorated diagram sheets and progress outlines have 50-pack. Transcribers, educators, students, and guardians would now be able to stamp anything from maps to machines. They can build geometric and different figures and diagrams identified with math, variable based math, geometry, trigonometry, and analytics which comprise of a stopper board mounted with an elastic tangle embellished with a 34 x 30 lattice of 1/2 inch squares. Included are three level spring wires, 14 push sticks, and elastic groups. The examination investigated the presence and ampleness of these critical instructing helps.

Math Window is a simple to-utilize math training device using attractive tiles on an advantageously measured work surface. It is versatile and accompanies its own conveying case. Math ideas are more clear utilizing this material strategy for building and taking care of math issues. Tiles can straddled along the border of the board or on our new connectable tile bed (Orton & Frobisher, 1996). It assessed availability of this teaching tool and other related tactile materials used by learners with visual impairment in learning Mathematics.

The literature reviewed is partly in line with the objective on availability of teaching and learning materials expected for learners who are blind. However, this research wishes to address how the tactile Mathematics materials are used in order to improve on Mathematics performance for leaners who are blind.

2.3 Adequacy of the Tactile Teaching and Learning Materials

The achievement of educating and learning depends to the accessibility of and powerful utilization of instructing materials. Babu (2005) perceives the need to utilize the important gear and ad lib the fundamental learning helps utilizing locally accessible materials. Accessibility of instructing and learning assets are an essential in deciding the exhibition of Mathematics by students with VI. On the off chance that the instructor of Mathematics would like to bestow change and improvement in the presentation, there must be sufficient and suitable assets as far as structures and educating or learning assets. Absence of assets adds to low quality of training (Kimani, 1990).

As per Kimani, (1990), the utilization of instructing and learning materials gives students higher odds of showing improvement over those students who don't utilize them. The insufficiency of the getting the hang of, training materials and gear in the school has a significant commitment towards horrible showing of Mathematics. Students going to inadequately prepared schools have an inclination of performing ineffectively. Instructors ought to have the option to distinguish straightforward showing helps from the earth and ought to likewise have the option to make a portion of the educating helps. Therefore, a few instructors abstain from utilizing training helps in their exercises and this adversely influences the student's exhibition. In order to teach Mathematics to learners who are totally blind, specialized resources such as Brailed textbooks, abacus, graph boards, cubes and cuberithm boards, graphic art for Mathematics, Sewell kit, Brailed geometrical

equipment, talking calculators and types with boards should be made available to the learner.

The instructing of Mathematics to students with visual disability ought to be finished by a uniquely prepared educator who is acquainted with the utilization of these particular gadgets (Tinsley, 2007).

Flanders (1965) supported by Yunus et al, 2009 both asserts that learners should be provided by the teachers with appropriate learning resources for example, course readings notwithstanding reasonable Mathematics learning gadgets. According to Cummine (1986), teachers should be innovative in training learners with visual impairment through organizing Mathematics layout in writing and adapting the syllabus in order to suit the learners. Further, the use of models for any 3-dimensional concepts is highly recommended when teaching visual impairment students. When Teaching Mathematics involves a lot of diagrams that need to be specially developed for reading tactually by learners with VI. These tactile diagrams should not use excessive details and should have good contrast in construction materials (Yunus et al., 2009).

In Kenya, instructing and learning assets for students with VI has been to a bigger degree gave by NGO's, for example, Christofel Blinden Mission. With the presentation of free essential training in January 2003, the administration began giving assets to the acquisition of educating and learning assets in these schools, however these assets might not have been satisfactory to buy the necessary assets, for example, the course books, Cramer math device, Braille, 3D squares and cuberithm boards. The researcher strongly

agrees with the related literature in this section since the adequacy of resources is not yet established, the researcher sought to investigate the extent to which learners who are blind are involved in availability and use of tactile resources in their daily learning processes in relation to their performance in Mathematics.

2.4 Challenges Faced by Teachers and Learners in Adopting Mathematical Teaching and Learning Materials

Challenges reported by teachers who teach learners with VI for example, government employed teachers suggest lack of skills and knowledge on use of resources to teach Braille Mathematics. Hill, (2002) states that there exists limited adopted Braille Mathematics teaching aid that teacher may use like Braille protractor, rule, compass and other adopted equipment which are key component during the learning and teaching and of Mathematics. Instruction time is often short during lesson presentation because learners who are TB need more individualized attention for them to adequately conceptualize a mathematical concept, yet the time provided for mathematical lesson is only 40 minutes. This time limitation makes the teacher not to attend to TB effective and may even rush through the content to finish the syllabus leaving some conceptualization gaps in the content taught (Bansal, 2007). Shortage of Mathematics Braille books makes teaching and learning of Mathematics teacher-centered an approach which is not frequently recommended for large group of learners, hence not suitable for learners who are VI (Martin & Harel, 1999).

Furthermore, Jordan, Carlile, & Stack, (2008) carried out research on the intellectual development through progressive building up of mental images. Images that can be memorized recalled and manipulated. It is in this study whereby they identified that learners with VI encounter difficulties.

This suggests that a stimulating environment and rich experiences need to be provided for learning Mathematics. Descriptions of Mathematical concepts that intrigue to perception might be gotten a handle on quickly by the located students while they require fundamentally progressively subjective preparing for the individuals who are visually impaired (Davis & Mason (1998). Many teachers may find it hard to provide stimulating environment and rich experiences suggested above because they tend to concentrate a lot on visual descriptions.

The Standard British Mathematics Braille notation is a teaching reference which is available in Kenya for Teachers' use. It however, requires that the Mathematics teacher be proficient in Braille. This is somehow hard for Mathematics teachers in the schools for learners who are blind because teachers are often deployed because of their subject expertise rather than special needs education training. This discrepancy may pose a lot of challenges especially where they need to align the set Braille Mathematics standards with the Mathematics standards designed for sighted learners. The researcher strongly agrees with this related literature because this study explored challenges teachers faced as they try to impart Mathematics skills to learners who are blind in Thika High School for the Blind (Kenya National Examination Council, 2005).

2.5 Perception of Learners Who Are Blind on Tactile Learning Mathematics Materials

Guimaraest (2005) suggests that perceptions are important in learning Mathematics since they create mental set or demeanor of preparation to react and the mental premise of frames of mind and changelessness. Frames of mind are not simply latent. They are an aftereffect of past encounters. They outline conduct and guide its structure and way. The segments of frames of mind are: a psychological segment (sentiment data or quality of conviction or mistrust; a full of feeling segment (passionate part of like or despise) and an activity (co-nature conduct segment of propensity or preparation to react) (Mohammed & Waheed, 2010).

Perceptions of learners who are blind towards Mathematics may affect their performance, interests and careers. Particularly a few students who are visually impaired have very negative assessment about Mathematics in view of negative practices of educators or wrong encounters. These students who are visually impaired have some preference, for example, Mathematics is a complicated exercise and just the individuals who have math intuition can learn it. However, teachers can increase positive experiences of learners towards Mathematics resulting to change of negative attitudes of learners who are blind into positive (Koc & Sen, 2006).

In Africa, perception of learners who are totally blind in tactile Mathematics learning resources has affected their performance and is brought about by the tactile learning Mathematics resources used as they are not widely used and available while in developed

sates like USA, Britain and South Africa perception of learners who are totally blind in tactile Mathematics learning resources are usually positive due to wide range of resources and readily available.

Nevertheless, there are analogies among the other used strategies which this present study investigated and used. Tactile Mathematics resources also impact on the perceptions towards Mathematics performance, for example when the resources are readily available and knowledge on its usage help the learners to perform better in Mathematics. The researcher therefore agrees with the related literature.

2.6 General Performance of Mathematics by Learners who are Visually Impaired

Mathematics performance has always been given great importance in education. The Cockcroft report (1982) conducted in USA identified that each youngster should ponder Mathematics at school. Orton (1994) focused on that for there to be a successful method for advancing realizing there ought to be nonstop obligation of educators to search out and practice what they accept to be the best methods for advancing learning.

Under accomplishment in Mathematics has become the examination focal point of most Mathematics teachers. The disturbing issue in Mathematics could be examined from the social viewpoints and every individual perspective (Belbase, 2006). The social perspective incorporates learning condition which has the job to urge students to be free and figure out how to cultivate regard among them in delivering various methodologies in critical thinking (Bishop, 1998).

Difficulties in figuring out how to peruse and compose Braille in Kenya exist in the territory of receiving of materials for understudies with visual disabilities. Albeit a few subjects, for example, Sciences, Social Studies and Mathematics examined in grade schools had prospectuses adjusted for understudies with visual impedances in which complex psychomotor exercises were supplanted by progressively reasonable ones, most schedules utilized as a rule instruction classes don't have facilities as far as adjusted exercises for students with visual disabilities (Ormrod, 1995). Absence of assets makes it difficult to give required class level Mathematics course books and materials to be utilized with Braille machines. That made it incredibly hard for understudies with visual weaknesses to peruse and compose Braille as smoothly as required. In spite of the fact that Education Assessment and Resource Center (E.A.R.C) were engaged with the recognizable proof of students with visual impedance, there is have to create serious early mediation administrations for babies and kids with visual hindrance. The advantages of early intercession can't be over underscored.

The State Board of Education (1997) advises that Braille Mathematics norms are sent in "following structure" with the goal that instructors, guardians, and heads can without much of a stretch see the contrasts between learning Mathematics utilizing print (visual medium) and learning Mathematics utilizing Braille (material medium). The Braille Mathematics benchmarks are coordinated with the Mathematics Content Standards for California Public Schools in USA.

The Braille Mathematics strategies that have been added address setting up Braille math problems and the mechanics of reading, use of the abacus as a calculation tool, use of tactile graphing devices and use of Braille math symbols.

In a technologically advanced society it is essential for learners with visual impairments to have early and continuous experience interpreting and preparing tactile graphics. These are basic abilities that students who are visually impaired need to ace. The extra techniques obviously exhibit that Braille students must get progressing, orderly, every day guidance via prepared instructors of the visually impaired throughout the learners' educational program.

A lot of thought and exchange occurred during the advancement of these techniques as for the request where the math device and Braille scientific images are educated and at what evaluation levels. Despite the fact that there is incredible variety by and by the choice ought to rely upon the individual understudy's needs and qualities, the levels being taught, and the textbooks being used. For example, one might think that teaching the abacus is outdated or unnecessary. The abacus is an important and essential tool for mathematical calculations as is the braillewriter, the slate and stylus, or the talking calculator (Hansen, 2005).

In secondary school and middle school and, the successful utilization of particular innovation (PC and online wellsprings of data and Braille electronic note takers, scanners, screen perusers, embossers, and and material charting gadgets Braille/print interpretation programming,) becomes fundamental for getting to data and acquiring

advanced mathematical concepts. It is important to note that learners must learn a myriad of new Braille math symbols for algebra, geometry, trigonometry, mathematical analysis, and calculus.

Particularly at the high school level, the teacher of learners with visual impairments must work in close coordination with the general education Mathematics teachers. It is essential that blind learners have the specialized Braille skills and knowledge of Mathematics to compete with their sighted classmates. With the advent of high stakes testing for all high school learners in Kenya, blind learners deserve and require the tools and services that ensure success. The creation of Braille Mathematics standards in Kenya by KICD sends a clear message: Learners who are blind or visually impaired and their teachers are to be held accountable for meeting the Mathematics content standards to the same extent as are sighted learners. This study explored the overall performance in Mathematics by learners who are totally blind (Wanjohi, 2003).

Kiplagat, Role, & Makewa (2012), conducted a study to establish the relationship between pupil's academic performance and Mathematics conducted in Western Kenya whereby 280 class 8 pupils and 74 Mathematics teachers were involved. They made use of casual comparative research design. Stratified, random and purposive sampling techniques were used to get the sample for the study. They collected their data using a self-constructed questionnaire and data was analyzed using both descriptive and inferential statistics.

The findings of this study suggested that educators from high performing schools evaluated appraisals in Mathematics, teacher's use of learning resources, teacher preparations and teaching strategies, higher than the low performing schools. This study was conducted in public primary schools whereby the respondents did not have impairment.

The current was a case study which involved learners who are blind, Mathematics teachers and the head teacher unlike the above study which did not involve the principal.

2.7 Summary of Literature Review

The restrictions forced by loss of sight bring about more dependence on contact and auditory senses. Teachers may experience challenges but may fail to disclose them until an anonymous setting is provided which this study created to enable them express what they went through while teaching Mathematics to learners who are blind and more so in some particular regions thought about confounded and frequently overlooked by the teachers. Agrawal (2004) had earlier stated that these omissions cause discrepancy among the learners due to learning gaps in the subject, leading them to a disadvantage. If they are not provided with the necessary content, they may not be able to cope with the learning standards the sighted learners attain. Hence, this study investigated the extent to which learners who are totally blind are taught Mathematics braille and how teachers use tactile resources in their daily teaching processes.

Mathematics Braille Resources have an important role to play in allowing teachers to model or demonstrate representations of mathematical ideas and in supporting children's

developing mathematical understanding and thinking which has not been well utilized. Blind person gains knowledge of the special qualities of objects only by tactile observations in which kinesthetic experiences play an important role which the teacher must emphasize on. Several researchers have sought to develop methods of representing complex equations to the blind.

The Nemeth's method is one of the simplest and most flexible. Nemeth's Code, devised by Dr Abraham Nemeth has been widely taught since 1952. It is relatively simple for a Braille reader to follow and is context independent, so it can be used in connection with any mathematical discipline (Ostad, 2000). This study explored teachers' awareness of this code because it may not be widely used in Kenyan context. The study assessed knowledge of The Standard Braille Mathematics Notation which is the recommended resource in Kenya and other common tactile materials used by learners with visual impairment in learning Mathematics. It sought to find out whether teachers have these resources for teaching and investigate the adequacy of these resources for use by learners who are blind. This study also explored the perceptions of learners who are blind on Mathematics as a subject and tried to compare whether they shared the same opinions with their teachers. Finally, it sought to establish the relationship between tactual Mathematics teaching and learning resources and Mathematics performance learners who are blind in Thika high school for the blind.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methods applied in the achievements of this study's objectives. It explains the research design, variables, location of the study, target population, sampling procedures, sample size, research instruments, pilot study, validity and reliability, data collection procedures, data analysis techniques and logistical and ethical consideration.

3.2 Research Design

A research design holds together all the elements in a research project (Kombo & Tromp, 2006). This study used case study design using quantitative methods of collecting data. The current research was a case study which enabled the researcher to closely examine the data within a specific context. The researcher examined the relationship between tactile materials and performance in Mathematics. In most cases, a case study design selects a small geographical area or a very limited number of individuals as the subjects of study. In this case, the researcher selected a single school and a sample to represent the target population. This design in its actual quintessence, investigates and explores contemporary genuine marvel through itemized logical examination of a predetermined number of people or conditions, and their connections (Orodho, 2010). Yin (1984:23) recognizes the contextual analysis investigate plan "as a definite solicitation that looks at contemporary miracle inside its veritable setting; when the cutoff points among wonder

and setting are not undeniably self-evident; and in which different wellsprings of confirmation are used.

3.2.1 Study Variables

A variable is a concept that stands for variation within a class of objects such as sex, intellectual ability, achievement and motivation (Orodho, 2005). The dependent variable in this study is performance in Mathematics. The independent variables in this study was tactile teaching and learning resources, adequacy of tactile materials used in Thika High School for the Blind, challenges that teachers face while adapting Mathematics tactile materials and learners' perception on Mathematics tactile materials.

3.3 Location of the Study

The study was carried out at Thika High School for the Blind in Kiambu County. The school was purposively sampled since it was the first school for learners with Visual Impairment to be established in Kenya, has a high population of learners who are blind with a long history in serving and educating learners with Visual Impairment in the country especially Mathematics. Being a national school, it has a solid foundation and has proved some effort in sourcing Mathematics teaching and learning materials hence an icon in championing education for the visually impaired. The ministry of education usually consults from the school and the school has structures and commendable resources for learners with VI.

3.4 Target Population of the Study

Target population is a set of elements that the researcher focuses upon and to which the results obtained by testing the sample should be generalized (Orodho, 2005). Thika High school for the Blind has 80 learners who are Totally Blind.

All the eighty learners who are blind qualified to participate in the study. The learners were divided into 36 boys and 44 girls and the five Mathematics teachers in the school making a total of 85 respondents.

3.5 Sampling Techniques and Sample Size

3.5.1 Sampling Technique

The researcher used purposive sampling technique to select teachers who taught Mathematics at the school. The researcher listed all teachers who taught Mathematics in all the classes for purposes of obtaining information on the topic of study. Purposive sampling focuses on particular characteristics of a population that are of interest, which best enabled and helped answer research questions.

Stratified random sampling was used to select the learners. The learners were stratified according to class and gender and thereafter simple random sampling was used to select 24 learners.

3.5.2 Sample Size

A sample of 29 respondents comprising of 5 Mathematics teachers and 24 learners who are blind in Thika High School of the blind.

Table 3.1: Sampling Grid

Type of respondent	Population	Sample	Percentage (%)
Mathematics teachers	5	5	100
Learners who are Totally Blind	80	24	30
Total	85	29	

3.6 Research Instruments

The study used data collection instrument in form of questionnaires administered to all learners who are blind in the school and Mathematics teachers to collect the data. The questionnaire comprised of both open and closed ended questions. The closed ended questions were used because they were easy to analyze and in an immediate usable form. However, the open ended and questionnaires questions were used to encourage the respondent to give in-depth response.

Burman, (2002) states that the questionnaire method of data collection is quite popular, particularly in case of big enquiries and hence questionnaire method was considered most appropriate as an instrument for the study. Questionnaires are practical and applicable to the research problem and the size of the population. It is also cost effective and gives adequate time to the respondent to fill in and return to the researcher. Secondary data was from books and documents from the school. Documents analysis was employed to explore student performance over the previous 5 years.

3.6.1 Questionnaires

This study used questionnaires for learners and questionnaires for Mathematics teachers.

3.6.2 Questionnaire for the Mathematics Teachers

Teachers' questionnaire was both close ended and open ended which give them a chance to give their opinion on the performance of the learners in the Mathematics subject. It enabled the researcher to gather information on the common tactile materials that teachers used while they are teaching, challenges that teachers face while adapting tactile materials and the adequacy of tactile teaching and learning materials. It gathered information on learner's performance in Mathematics.

3.6.3 Questionnaire for Learners

The questionnaire for learners was both close and open ended. While the structured section was easy to fill and kept the respondent on the subject, the unstructured sections of the questionnaire allowed them to express themselves freely without restriction.

3.7 Pilot Study

The pilot study was conducted at St Lucy Secondary School for the Blind with a sample of 2 Mathematics teachers and 12 Mathematics learners who are blind, before embarking on the main study. St Lucy Secondary School for the Blind was selected because it has similar characteristics as Thika High School for the Blind.

Robson (2010) contends that guiding gives chance to the researcher to test their trust in distinguishing troubles and impediments that could influence the genuine assortment of valuable information. The pilot study assessed the adequacy and validity and reliability quality of the instruments.

3.8 Validity and Reliability

3.8.1 Validity

According to Jablensky (2003) validity can be defined by the extent to which any measuring instrument measures what it is intended to measure. The tool was developed according to the study objectives to ensure content validity. The pilot study results assisted the researcher to establish content validity and reliability of the test instruments. Guidance from the supervisor and other experts was applied to determine validity.

3.8.2 Reliability

Orodho (2010), define reliability as a measure of the degree to which the research instruments yield consistent results or data after repeated trials. The pilot study used test - retest method to explore the logic, clarity and objectivity of questions in the questionnaire. The reliability of the research instruments for this study was measured and calculated using the test-retest method. Thus, the questionnaires were administered to the group members twice with a break interval of two weeks between the first and the second administrations. After administering the second test instrument, the results were correlated using Pearson's product moment correlation and a correlation co-efficient of 0.75 was obtained and considered high enough for reliability of the instruments.

3.9 Data Collection Procedure

The primary data was collected using a questionnaire procedure, where the questionnaires were administered to the selected 29 respondents. After notifying the administration on intention of collecting data, teachers who were respondents were assembled and given

questionnaires while teachers and learners who were TB were assisted in filling in the questionnaires since the questionnaires were in print. Secondary data was retrieved from school documents. In collecting data, professionalism was adhered to and data collected within two months with the help of two research assistants who were had specialized in Braille and special needs education.

3.10 Data Analysis and Presentation

Data was collected using questionnaires, organized, coded and cleaned from the field to ensure that it is error free. In the case of quantitative data, the researcher numbered the questionnaires appropriately. This was followed by the coding process to mark and categorize information such as gender, age and level of education. Statistical Package for Social Sciences (SPSS) program was used to analyze the data. The presentation of the results was done by using charts, tables, graphs depicting frequencies and percentages.

3.11 Logistical and Ethical Considerations

The researcher first sought for a permission letter from Kenyatta University to go and carry out the research. Consent from the National Council of Science, Technology and Innovation headquarters was sought to ensure the researcher had a research permit to legally conduct the research.

The Thika Town Sub-County administration and School administration was contacted and a consent letter given to collect data. The research participants were informed of the purpose of the study and its possible benefits before data collection, with the aim of seeking their consent to participate in the study, ensuring voluntary participation and

giving them free room to withdraw their participation from the study any time they wished. The questionnaire was self-administered. Data gathered in this study was summarized so as to establish the fundamental results. The results of the inferential statistics addressed each research question.

Adequate measures were taken to protect the confidentiality of respondents. The measures included the participants not disclosing their names and the access to the information provided by the respondents was only by the researcher and they were not required to give any personal information.

The information collected was used to address the issue of poor performance among learners who are blind. The teachers did not lose their jobs or get interdicted for providing any information.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

The purpose of this study was to establish the relationship between tactile materials on performance of Mathematics in Thika High School for the Blind. The study findings of the study are presented, analyzed and discussed guided by the study objectives:

i) To identify the tactile Mathematics materials used by teachers while teaching learners who are blind.

ii) To explore the adequacy of the tactile Mathematics learning and teaching materials in Thika High School for the Blind.

iii) To identify the challenges that teachers face in adapting tactile Mathematics teaching and learning material.

iv) To investigate learners' perception on the tactile Mathematics learning materials in relation to performance in Mathematics.

v) To determine general performance of mathematic among the learners who are blind.

4.2 Demographic Characteristics of Respondents

A total of 29 respondents participated in the study by answering questionnaires, comprising of 24 learners and 5 teachers. The demographic characteristics of the learners were: age, level of study, preferred course of study and confidence in Mathematics. Teachers' demographic characteristics included; gender, highest level of education, professional qualification, training in special needs and teaching experience.

4.2.1 Demographic Characteristics of Learners

Table 4.1: Demographic Characteristics of Learners

Characteristics	Frequency	Percent
Age		
14-17 years	7	29.2
18-21 years	14	58.3
22-24 years	3	12.5
Total	**24**	**100.0**
Level of Study		
Form one	6	25.0
Form two	6	25.0
Form three	6	25.0
Form four	6	25.0
Total	**24**	**100.0**
Math's grade in Class Eight		
A	1	4.2
B	5	20.8
C	15	62.5
D	3	12.5
Total	**24**	**100.0**
Preferred Course of Study		
Science Course	13	54.2
Arts Course	11	45.8
Total	**24**	**100.0**
Level of Confidence in math		
Very confident	2	8.3
Confident	16	66.7
Not confident at all	6	25.0
Total	**24**	**100.0**

As shown in Table 4.1 above, majority of the respondents 14 (58.3%) were aged between 18-21 years while a few 3 (12.5%) were in the age range of 22-24 years. The rest 7 (29.2%) were in the age range of 18-21 years. It is worth noting that these learners are older than expected at this level of education. Specifically, those in 22-24 should be in

postsecondary institutions. Probably, they enrolled in school late or are victims of repetitions hence; thus delaying at the lower levels of their education. There are often no repetitions in secondary schools.

An exploration of their performance in Mathematics before joining secondary education revealed that majority 15 (62.5%) of the respondents were able to attain grade C in KCPE). A quarter 6(25%) had obtained between grades A and B and only 3(12,5%) had D score. The implication of these findings is that learners who are blind perform well in Mathematics at the primary level because none indicated failure or grade E. When asked what they preferred to pursue at the secondary school level, majority 13 (54.2%) of the respondents preferred to pursue a Science course in the future and Mathematics is often classified as a science course. Furthermore, 66.7% of the respondents indicated being confident in Mathematics. This affirms Maguvhe 2015 suggestions that learners who are blind have the same mental capacity to comprehend Mathematics and merely need to be appropriately accommodated to enable them to perform as well as their sighted counterparts in Mathematics.

4.2.2 Demographic Characteristic of Teachers

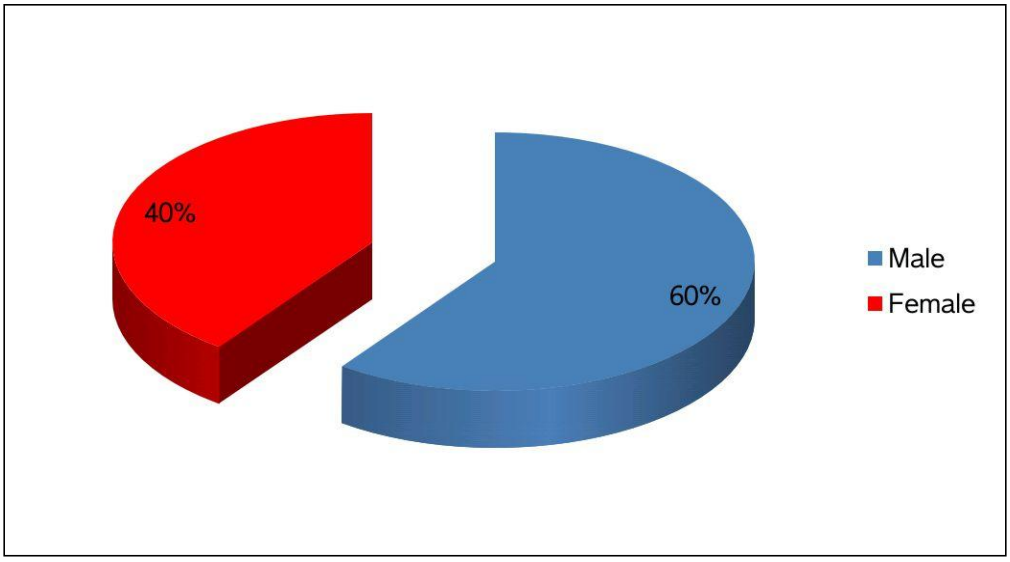

Figure 4.1: Gender of Respondents

Figure 4.1 above, 60% of the respondents were males, while 40% of the respondents were females. The findings showed that there are more male teachers teaching Mathematics than their female counterparts. This may have a bearing on Yunus and Ali (2009) study that states that students like being taught by male teacher than female teacher.

Table 4.2: Demographic Characteristics of Teachers

Characteristics	Gender			Percent
	Male	Female	Total	
Highest Level of Education				
University	2	3	5	100.0
Professional qualification				
Bachelor of Education		5	5	100.00
Training in Special Needs				
Yes	5			100.00
Level of Training in Special Needs				
Certificate	4			80.0
Degree	1			20.0
Teaching Experience				
6-10 years	3			60.0
Over 10 years	2			40.0
Total				**100.0**

As shown in Table 4.2 above, all respondents indicated having attained the university level of education and consequently attaining Bachelor of Education as their professional qualification. All the respondents also showed that they had been trained in special needs, with majority of them (80%) being trained up to the certificate level. More than half of the respondents also had a teaching experience of between 6-10 years. This findings conquers with Vinner (1991) and Wanjohi, (2003) that level of education, professional qualification and as well as teaching experience of teacher contributes greatly toward performance in Mathematics as they regularly interact with learners and have mastered mathematical skills and how to impact the knowledge to the learner.

4.3 Tactile Mathematics Materials used by Teachers while Teaching Learners who are blind in Relation to Performance in Mathematics

Objective one sought to find out the tactile materials that were used by teachers to teach Mathematics to learners who were blind.

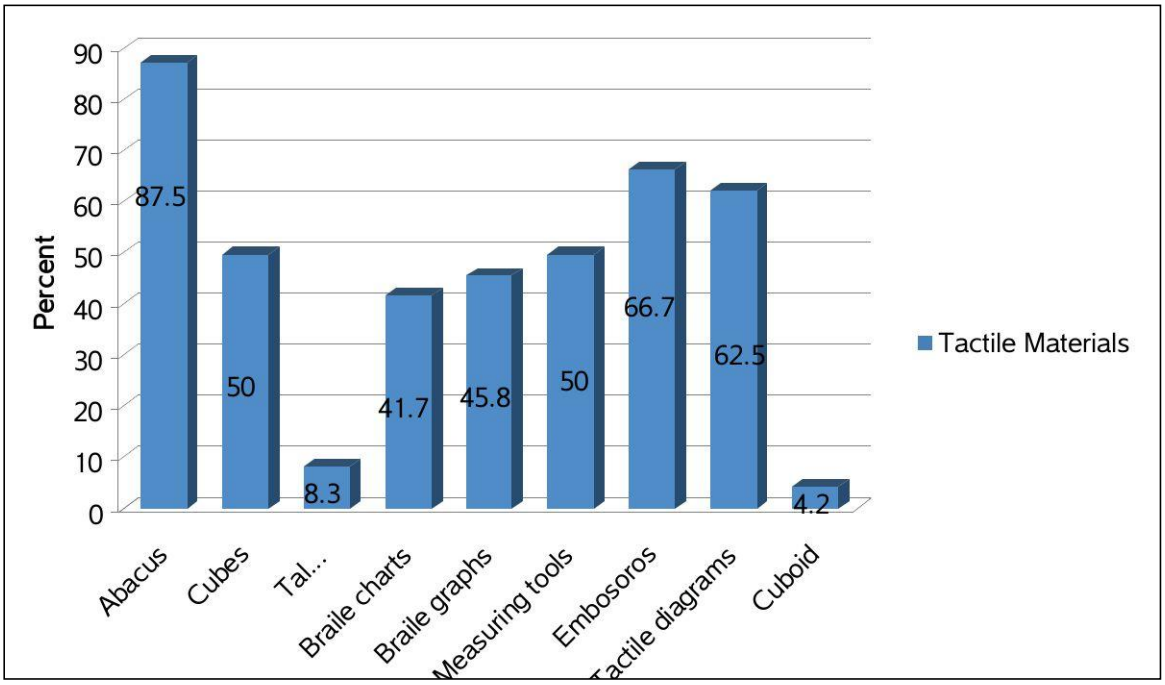

Figure 4.2: Tactile Materials Used in Teaching Mathematics

As shown in Figure 4.2 above, majority of the respondents (87.5%) indicated that abacus was used to teach Mathematics in their schools. More than a half (66.7%) indicated that embossers was used, while an almost equal number (62.5%) indicated that tactile diagrams were used. However, only a few of the respondents (8.3%) and (4.2%) indicated that talking calculators and cuboid were used respectively.

This findings ascertain that Mathematics lesson uses variety of tactile materials during learning and teaching. Therefore, in line with Wheeler (2004), Tinsley (2007) and Thamburaj & Nagar (2010) statements that for better performance, these materials need to be widely adopted to the needs of the learners effectively and efficiently.

To further answer this objective, Pearson correlation coefficient was conducted between the tactile materials used in teaching and learners' performance in testing the null hypothesis that: H_{o1}: There is no statistically significant relationship between the tactile Mathematics materials used in teaching learners who are blind and Mathematics performance.

The findings are as shown in the table below.

Table 4.3: Pearson Correlation Coefficient between Tactile Materials used in Teaching and Performance in Mathematics

		Performance
Tactile Materials	Pearson Correlation	.335
	Sig. (2-tailed)	.110
	N	24

As shown in Table 4.3 above, there was a weak positive relationship between tactile materials used in teaching and performance in Mathematics, r (22) = 0.335, p =0.11. This implies that the higher the availability of tactile materials, the higher the performance in

Mathematics. However the relationship that was not statistically significant at 0.05 level, hence, the null hypothesis was accepted.

4.4 Adequacy of the Tactile Teaching and Learning Resources on Mathematics Performance

To answer this objective, the researcher presented both the learners and teacher respondents with items that enquired on the adequacy of the learning resources. The respondents rated the adequacy on a five point Likert Scale items (1-very inadequate, 2-inadequate, 3- not sure, 4-adequate, 5-very adequate). The findings are as shown below:

Table 4.4: Learners Perception on the Adequacy of Learning Resources

Resource	VA		A		NS		IA		VIA	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Library resources	4	16.7	17	70.8	1	4.2	2	8.3	0	0.0
Mathematics text book	6	25.0	13	54.2	1	4.2	4	16.7	0	0.0
Qualified and cooperative teachers	9	37.5	10	41.7	1	4.2	2	8.3	2	8.3
Time to learn Mathematics	2	8.3	18	75.0	0	0.0	3	12.5	1	4.2
Class size (No of Learners)	6	25.0	14	58.3	0	0.0	1	4.2	3	12.5

From Table 4.5 above, majority (70.8%) of the respondents indicated that the library materials were adequate, about a half (54.2%) also indicated that the Mathematics textbooks were adequate, with only a few (16.7%) indicating that they were inadequate.

Three quarters (75%) of the respondents noted that there was adequate time to learn Mathematics with less than a half (41.7%) indicating that there were adequate qualified and cooperative teachers.

These findings indicate that adequacy of the tactile teaching and learning resources on Mathematics may impact vastly on performance. Hence, there is need to provide them to the learners and teachers to improve performance. Thamburaj, & Nagar, (2010), Munsanje, (2011) and Kenya National Examination Council (2005) indicates that adequacy of the tactile teaching and learning resources on Mathematics should be provided to each and every learner regardless of his or her disability and ability during teaching and learning of Mathematics.

Table 4.5: Teachers Perception on the Adequacy of Learning Resources

Resource	**VA**		**A**		**NS**		**IA**		**VIA**	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Library facilities	1	20.0	2	40.0	0	0.0	2	40.0	0	0.0
Mathematics textbook	1	20.0	2	40.0	0	0.0	2	40.0	0	0.0
Availability of qualified and cooperative teachers	2	40.0	3	60.0	0	0.0	0	0.0	0	0.0
Time to learn Mathematics	1	20.0	1	20.0	0	0.0	1	20.0	2	40.0
Class size (No of learners)	1	20.0	1	20.0	0	0.0	1	20.0	2	40.0
Measuring tools	1	20.0	1	20.0	0	0.0	0	0.0	3	60.0

As shown in Table 4.5 above, more than a half (60%) of the respondents indicated that there were adequate qualified and cooperative teachers, the same number (60%) of the respondents also indicated that there were very inadequate measuring tools. Less than a half (40%) of the respondents indicated that there were both adequate and inadequate library facilities.

To further answer this objective, the scale was collapsed into numerical scores and then correlated with the learners' performance in Mathematics to test the null hypothesis that:

Ho1: There is no significant relationship between adequacy of learning resources and performance in Mathematics among learners who are blind.

The findings are as shown below:

Table 4.6: Correlation between Adequacy of Learning Materials and Mathematics Performance

		Adequacy of learning materials
Mathematics Performance	Pearson Correlation	.140
	Sig. (2-tailed)	.513
	N	24

From Table 4.6 above, there was a weak positive relationship between adequacy of learning materials and performance in Mathematics, r (22) = 0.14, p = 0.513. This means that availability of adequate learning materials is associated with higher performance in

Mathematics. However, the relationship that was not statistically significant at 0.05 level. From the findings, the null hypothesis was thus accepted.

4.5 Challenges that Teachers Face in Adapting Mathematic Tactile Teaching and Learning Material

This objective sought to find out the common challenges that teachers faced in adapting tactile teaching and learning materials and whether these challenges influenced student performance in Mathematics. To answer this objective, the respondents indicated on how much they agreed with the intensity of the challenges on a five point Likert's scale items (1-strongly disagree, 2-disagree, 3- neutral, 4-agree, 5-strongly agree). The findings are as shown below:

Table 4.7: Challenges Faced by Teachers in Adopting Tactile Learning Materials

Challenge	SA		A		N		D		SD	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Lack of skill on tactile Mathematics material	0	0.0	0	0.0	1	20.0	2	40.0	2	40.0
Inadequate tactile Mathematics teaching and learning materials	0	0.0	1	20.0	1	20.0	0	0.0	3	60.0
Time shortage during lesson	0	0.0	1	20.0	2	40.0	1	20.0	1	20.0
Syllabus	0	0.0	0	0.0	1	20.0	3	60.0	1	20.0
Shortage of Mathematics braille books	0	0.0	1	20.0	0	0.0	3	60.0	1	20.0
Learning environment	0	0.0	0	0.0	2	40.0	3	60.0	0	0.0
Mathematics braille code	0	0.0	0	0.0	0	0.0	2	40.0	3	60.0
Learners attitude	0	0.0	0	0.0	1	20.0	1	20.0	3	60.0
Nature of mathematical content	0	0.0	0	0.0	1	20.0	0	0.0	4	80.0

From Table 4.7 above, majority (80%) of the respondents strongly disagreed that the nature of mathematical content was a challenge in adopting tactile learning materials, more than a half (60%) disagreed that the syllabus, shortage of mathematical braille books and learning materials gave them challenges respectively. in excess of a half of the respondents (60%) also strongly disagreed that the learners' attitude was a challenge. Only a few (20%) of the respondents agreed that inadequate tactile Mathematics teaching and learning materials were posing challenges to them.

Teachers face various and varied challenges in adopting tactile teaching and learning materials. Jordan, Carlile, & Stack, (2008) affirms that this adversely affect the performance of Mathematics toward learners as some teachers do not know how to deal or navigate these challenges and make them learning models or opportunities while teaching learners with VI.

To further answer this objective, Spearman Rank Order Correlation coefficient was run between the challenges and learners' performance to test the null hypothesis that:

H_{o1}: There is no statistically significant relationship between the challenges that teachers face in adapting tactile materials for Mathematics and performance in Mathematics.

The findings are as shown in Table 4.8 below.

Table 4.8: Spearman Rank Order Correlation between Challenges that Teachers face in Adopting Tactile Materials for Mathematics and Performance in Mathematics

			Performance
Spearman's rho	Challenges	Correlation Coefficient	-.250
		Sig. (2-tailed)	.685
		N	5

A shown in Table 4.8 above, there was negative relationship between challenges faced in adopting tactile materials and performance in Mathematics, rs (3) = -0.25, p=0.685. This implies that as the challenges in adopting tactile materials increase, the performance in Mathematics drops. However, the relationship was not statistically significant at 0.05 level. From the findings, the null hypothesis was thus not rejected.

4.6 Learners Perception on the Mathematic Learning and Performance in Mathematics

This objective sought to investigate the learners' perception Mathematics learning and how it affected their performance in Mathematics. To answer this objective, the respondents were provided with statements on various aspects of learning and were to rate on a five point Likert scale items (1-strongly disagree, 2-disagree, 3- neutral, 4-agree, 5-strongly agree). The findings are as shown below:

Table 4.9: Learners Perception on the Mathematics Learning

Perception	SA		A		N		D		SD	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Being a blind learner does not interfere with my active participation in Mathematics	8	33.3	7	29.2	0	0.0	5	20.8	4	16.7
Student-teacher interaction improves my understanding of Mathematics concepts	5	20.8	14	58.3	0	0.0	1	4.2	4	16.7
Teachers' gender influences my active participation in math teaching and learning process	4	16.7	4	16.7	0	0.0	8	33.7	8	33.7
The number of learners in class affect the teaching of Mathematics	4	16.7	4	16.7	0	0.0	11	45.8	5	20.8
Parents do not like learners who are blind to attend schools	1	4.2	1	4.2	1	4.2	6	25.0	15	62.5

As shown in Table 4.9 above, more than a half (58.3%) of the respondents agreed that student-teacher interaction improved their understanding of mathematical concepts. Almost similar number (62.5%) of the respondents strongly disagreed that parents do not like learners who are blind to school, while slightly less than a half (45.8%) of the respondents disagreed that the number of learners in class affect the teaching of Mathematics.

Learner's perception on the Mathematics learning is an important issue to note and identify immediately the learner commence schooling or learning Mathematics. This issue when dealt with it at an early stage may be reversed or corrected effectively hence improving on Mathematics performance.

Khoush-Bakht, Kayyer, (2005), Bans (2007). Driscoll, (2005), FEMSA, (1997), Fennema, & Sherman, (1976) and Yunus, & Ali, (2009) are in tandem with the finding of this study noting that learners perception on the Mathematics learning need to be nurtured at an early stage and strengthened regularly by practicing.

To further answer this objective, Pearson product moment correlation coefficient was run between perception of learners towards Mathematics learning and performance to test the null hypothesis that:

Ho1: There is no statistically significant relationship between learner's perception in learning Mathematics and performance in Mathematics.

Table 4.10: Pearson Correlation between Learners Perception in Learning Mathematics and Performance

		Performance
Perception	Pearson Correlation	.203
	Sig. (2-tailed)	.342
	N	24

A shown in Table 4.10 above, there was a weak positive relationship between learners perception in learning Mathematics and performance in Mathematics, r(22) = 0.203, p=0.342. This implied that leaners perception towards Mathematics was associated with a high performance in Mathematics. However, the relationship was not statistically significant at 0.05 level. From the findings, the null hypothesis was thus not rejected.

4.7 Performance of Mathematics Related Tasks among the Learners who are Blind

This objective sought to find out the frequency with which the learners performed Mathematics related tasks. This objective also sought to find out the extent to which various individuals surrounding the learners encouraged them to study Mathematics. The findings are as shown below.

Table 4.11: Frequency of performance of Mathematics related tasks

Task performance	Daily		2-3 days		Once per day		Once per week		Once per month	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Receiving homework from the teacher	21	87.5	1	4.2	2	8.3	0	0.0	0	0.0
Get homework marked	17	70.8	2	8.3	1	4.2	3	12.5	0	0.0
Doing homework alone	15	62.5	4	16.7	2	8.3	2	8.3	0	0.0
Doing homework in groups	12	50.0	9	37.5	1	4.2	1	4.2	0	0.0
Approaching the teacher for help	4	16.7	5	20.8	3	12.5	7	29.2	1	4.2
Receiving individual help from Mathematics teacher	3	12.5	7	29.2	6	25.0	3	12.5	0	0.0

From Table 4.11 above, majority (87.5%) of the respondents indicated doing their homework on a daily basis when given by the teacher, close to three quarters (70.8%) indicated getting homework marked daily, with in excess of a half of the respondents (62.5%) indicated doing homework alone on a daily basis. A few (29.2%) of the respondents noted that they approached the teacher for help once a week.

The findings of this study, are consistent with Thou (1985), and Thomas, (2006) who noted that frequency of performance of Mathematics related tasks affects student's achievements and attitudes using integrated learning systems with co-operative pairs on the tasks. Hence, the more frequent practice on Mathematics the better the improvement in Mathematics study. This also improve on the cognitive growth of the learner on learning Mathematics.

Table 4.12: Social Motivation to Study Mathematics

Task performance	**Very Much**		**Much**		**Little**		**Very little**	
	Freq	**%**	**Freq**	**%**	**Freq**	**%**	**Freq**	**%**
Peers/classmates	3	12.5	14	58.3	3	12.5	4	16.7
Class teacher	16	66.7	7	29.2	0	0.0	1	4.2
Career teacher	15	62.5	7	29.2	1	4.2	1	4.2
Mathematics teacher	14	58.3	5	20.8	2	8.3	3	12.5
Other Mathematics teacher	12	50.0	10	41.7	1	4.2	1	4.2
Principal	15	62.5	3	12.5	2	8.3	4	16.7

From Table 4.12 above, majority of the respondents (66.7%) indicated that their class teacher encouraged them very much to study Mathematics, more than a half (62.5%) indicated that their career teacher and their principal encouraged them very much to study Mathematics, while only a few (12.5%) indicated that their peers encouraged them very much.

Yunus, & Ali, (2009) explains that motivation in the learning of Mathematics from various aspects encourages learners to learn Mathematics. Hence, great impact in Mathematics performance as they are aware of the skill and knowledge to be applied during Mathematics lessons.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presented the summary of findings that highlighted: demographic information of respondents, the tactile Mathematics materials used by teachers while teaching learners who are blind in relation to performance in Mathematics, the adequacy of the tactile teaching and learning materials on Mathematics performance in Thika High School for the Blind, the common challenges that teachers face in adapting mathematic tactile teaching and learning material and Mathematics performance. In addition, the study explored learner's perception on the mathematic tactile learning materials and the general performance of mathematic among the learners who are blind. It further discussed conclusion of the findings, general recommendations and finally recommendations for further research.

5.2 Summary of the Findings

5.2.1 Demographic Information of Respondents

A total of 29 respondents participated in the study comprising of 24 learners and 5 teachers. Out of the 24 learners, (7) were aged 14-17 years (14) were aged 18-21 years and (3) were aged 22-24 years. On the other hand, 5 teachers also participated as respondents in the study indicated having attained the university level of education and consequently attaining Bachelor of Education as their professional qualification. All the teachers also indicated that they had been trained in special needs; with majority of them

being trained up to the certificate level. Majority of the respondents also had a teaching experience of between 6-10 years.

5.2.2 Tactile Mathematics Materials used by Teachers while Teaching Learners who are blind in Relation to Performance in Mathematics

The study found out that abacus was the most frequently used device to teach Mathematics. In excess of a half of the respondents also indicated that embossed tactile diagrams were used. However, only a few of the respondents indicated that talking calculators and cuboid were used respectively.

5.2.3 Adequacy of the Tactile Teaching and Learning Resources on Mathematics Performance

The study observed that the adequacy of tactile teaching and learning resources on mathematic were inadequate for both learners and teachers. This was noted with some of the learners indicating that the library materials were adequate, while others indicated that they were inadequate. Majority of the learners noted that there was adequate time to learn Mathematics and that their teachers were adequately qualified and cooperative. This view was also supported by teachers who also indicated that there were adequately qualified and cooperative teachers. Majority of the teachers indicated that there were very inadequate measuring tools.

5.2.4 Common Challenges that Teachers Face in Adapting Mathematic Tactile Teaching and Learning Material

The study found out that majority of the teachers did not experience challenges in mathematical content, the syllabus, shortage of mathematical braille books and/or learning materials respectively. Majority of the teachers were also not affected by the learners' attitude towards Mathematics as a challenge. Just a few of the respondents agreed that inadequate tactile Mathematics teaching and learning materials were a challenge. Therefore, the researcher concludes that the common challenges that teachers face in adapting mathematic tactile teaching and learning material does negatively affect Mathematics performance for learners with visual impairment.

The time allocated for teaching Mathematics was identified as a challenge. Majority of the respondents (both learners and teachers) observed that the time allocated for Mathematics was not adequate. Learners and teachers both observed that brailed Mathematics textbooks were not enough in the school. Most of the time, both learners and teachers sometimes get brailed materials late after a syllabus had been changed.

5.2.5 Learners Perception on the Mathematic Learning and Performance in Mathematics

It was found out that more than a half of the respondents agreed that student-teacher interaction improved their understanding of mathematical concepts. Most of the respondents strongly disagreed that parents do not like learners who are blind being enrolled in the school, while less than half of the respondents disagreed that the number

of learners in class affect the teaching of Mathematics. Hence, learner's perception on the Mathematics learning does negatively affect their Mathematics performance.

5.2.6 Performance of Mathematics Related Tasks among the Learners who are Blind

The findings showed that majority of the respondents indicated did their homework daily, oftentimes individually and teachers marked the work consistently. Just a few of the respondents approached the teacher for help once a week. Majority of the respondents indicated that they were encouraged to study Mathematics by their class teacher, career teacher and the principal while only a few indicated that their peers encouraged them to do the same. This may indicate learners' perception on the performance of Mathematics related tasks.

5.3 Conclusion

The study sought to investigate the relationship between tactile materials and performance in Mathematics among learners in Thika High School for the Blind, Kiambu County, Kenya. The study revealed that all of the teachers had special education training at different levels but not in visual impairment making this a major hindrance for them to effectively teach learners with visual impairment in Mathematics teaching and learning resources.

Most Mathematics teaching and learning resources used were books with audiovisual resources either lacking or used in only one school. Many of the respondents recommended the need for the government to set aside more funds for buying

mathematical teaching and learning resources since their use in teaching was of utmost importance.

The study further revealed that slightly more than half of the teachers find it difficult to make and plan on how to use mathematical teaching and learning resources. Though not covered by the study, there were difficulties in making good displays of educational resources in class. The implications for this on the education of learners with visual impairment are far reaching. Skills that involve thinking, solving problems and making appropriate judgment will be difficult to acquire. Most teachers are aware of the importance of mathematical teaching and learning resources for learners with visual impairment. The mathematical teaching and learning resources arouse children's curiosity 'and motivate them to learn. However, lack of proper planning, preparation, presentation, appropriate application and essential follow up make their use ineffective.

There is serious lack of Mathematics teaching and learning resources especially audio-visual resources. The findings established that almost all of the respondents indicated that the mathematical teaching and learning resources in schools are not enough. This trend is partly caused by low-level awareness by the integrated schools on the educational requirement for learners with visual impairment. Lack of finances was also noted as a major setback in the acquisition of mathematical teaching and learning resources particularly high technology resources such as computers.

Mathematics being a compulsory examinable subject in Kenya, learners with visual impairment tended to find it extremely challenging as compared to other subjects. The

findings shown limited efforts towards Mathematics exploration, interaction, and manipulation, use of Mathematics apparatus and promotion of continuous well supervised peer tutoring programmes.

Teachers of Mathematics did not ensure active and working discussion groups throughout the learners‟ educational process. Usually, teachers should continuously remind the other teachers to relate Mathematics with other regular subjects during instruction. They should further concentrate attention towards individual challenges in acquisition of Mathematic computational skills, slow manipulation of tools, poor concept formulation and incompetence in relating mathematical concept to the timing and manipulation of apparatus.

5.4 Recommendations

Based on the findings and conclusions, the following recommendations can be made.

5.4.1 Policy Recommendations

i) Training of teachers in Special Needs Education equips them with skills and knowledge that enable them to use effective teaching resources which enable learners with visual impairment to learn effectively in integrated schools. However, findings showed that teachers are not trained in assistive technology. There is therefore a need for the Ministry of Education and Culture to introduce AT courses in Teacher Training Colleges. Government should provide computers and computer software, mathematic kit, radio cassettes and tape recorders which are vital instructional materials in schools to enhance effective teaching and learning

Mathematics.

ii) More time should be allocated in the school timetable by the school administration for effective use of materials in teaching Mathematics to learners with visual; impairment.

iii) The government should partner with NGOs and International Organizations such as UNICEF and UNESCO to provide resources for instance computers, tape recorders, projectors and film projectors. Learning resource centers manned by qualified personnel should be established to serve as teachers' resource centers. Teachers for learners with visual impairment and other categories of learning disabilities could use such centers to update their skills in the appropriate application and use of resources.

5.4.2 Recommendation for Further Research

The researcher gives the following suggestions for further study

i) A similar study should be carried out in other regions to establish whether the study findings apply to other areas to enable generalization of the findings of this study to help improve on performance of Mathematics among learners who are blind.

ii) Further research can be done in rural settings and among private schools so that informed generalization of relationship between tactile materials and performance in Mathematics among learners in Thika High School for the Blind.

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APPENDICES

APPENDIX I

LEARNERS QUESTIONNAIRE

INSTRUCTION

You are requested to complete the questionnaire as accurately as possible. Your honesty and cooperation in answering the questions will help those in charge to improve your Mathematics Education. This information will be treated with confidentiality and only us ed for the purpose of this research study.

SECTION A: BACKGROUND INFORMATION

Form _____

Age _____

1. What was your KCPE grade in Mathematics?

_____

2. What course would you like to pursue at the achieved level of education mentioned ab ove? (Tick where appropriate)

a) Science course ( )

b) Arts course ( )

3. Give reasons for the choice in question 2 above.

_____

_____

_____

4. Do you like Mathematics subject? Yes /No

_____

a). If yes in question 4 above give reasons.

_____

_____

_____

_____

_____

b). If no give two reasons.

_____

_____

_____

_____

_____

5. What grade are you aiming to get in KCSE in Mathematics?

A ( ) B ( ) C ( ) D ( ) E ( )

6). How confident are you in Mathematics? (tick where appropriate)

(a)Very confident (b) Confident (c) Not confident at all

SECTION B: SCHOOL BASED FACTORS

6. How would you rate the adequacy of the following types of resources in your school?

VA =Very adequate, VIA= Very Inadequate, A= Adequate, IA= Inadequate,

NS=Not Sure

	VA	A	IA	VIA	NS
Resources					
Library Resources					
Mathematics textbook					
Qualified and cooperative teachers					
Time to learn Mathematics					
Class size(No of Learners)					

7. A) Listed below find tactile Mathematics materials used by teachers while teaching Ma thematics. Tick to materials available in your school.

Tactile Mathematics materials	
1.Abacus	
2. Cubes	
3 Talking calculators	
4 Braille charts	
5 Braille graphs	
6 Measuring tools	
7 Embosors	
8 Tactile diagrams	

b) Others please specify.

_____

_____

_____

_____

_____

8. To what extent would you say the following persons encourage you to study Mathemat ics?

VM= Very much, M= Much, L= Little, VL= Very little

	VM	M	L	VL
Peers/classmates				
Class teacher				
Career teacher				
Your Mathematics teacher				
Other Mathematics teachers				
Principal				

9. How often do you perform the following tasks?

Task(s)	Daily	2-3 days	Once per day	Once per week	Once per month	Specify others
Given homework by the teacher						
Get homework marked						
Doing homework alone						
Doing homework in groups						
Approaching the teacher for help						
Receiving individual help from Mathematics teacher						

12. Do you agree or disagree that the following problems affect your participation in Ma thematics (

(N=Neutral, SA= Strongly Agree, A= Agree, D= Disagree, SD= Strongly Disagree)

	SA	A	D	SD	N
Problems					
Lack of interest in the subject					
Inadequate Mathematics textbooks					
Lack of confidence					
Language used by teachers is difficult to understand					
Being sent home for fees					

13. Indicate whether you disagree or agree with the statements below.

, SD= Strongly Disagree, SA= Strongly Agree, A= Agree, D= Disagree

N=Neutral

	SA	A	D	SD	N
Being a blind learner does not interfere with my active par ticipation in Mathematics					
Student-teacher interaction improves my understanding of Mathematics concepts					
Student-teacher interaction improves my understanding of Mathematics concepts					
Teachers' gender influences my active participation in mat h teaching and learning process					
The number of learners in class affect the teaching of Mat hematics					
Parents do not like learners who are blind to school					

APPENDIX II

TEACHERS QUESTIONNAIRE

INSTRUCTIONS

Please read the questions provided below and answer them honestly. The information pro vided here is to be used strictly for the purpose of the study and will be treated with strict confidentiality.

A. Sex

1. Female ( ) 2. Male ( )

B. Highest level of education attained

a. University

b. Secondary form 6

c. Tertiary

d. Secondary form 4

C. Professional qualifications

1. B.Ed. ( ) 2.Diploma ( ) 3.B.Sc/BA 4. Others (specify)

D. Training in special education

1) Yes

2) No

If yes in D to which level.

1. Certificate ( )

2. Diploma ( )

3. Degree ( )

4. Others (specify)

E. For how long have you been teaching Mathematics to learners with VI?

a. Less than one year

b. 1-2 years

c. 3-5 years

d. 6-10 years

e. Over 10 years

F. How would you rate the interest of your learners in Mathematics?

a. Interested

b. Uninterested

G. How would you rate the perception of learners who are towards the following?

VP= Very positive, P= Positive, N= Negative, VN= Very Negative

	VP	P	N	VN
Mathematics				
Mathematics teachers				
Science teachers				
Principal				

H. How would you rate the adequacy and use of the following types of resources in your school in teaching Mathematics?

VA= Very adequate, A= Adequate, IA= Inadequate, VIA= Very inadequate,

NS= Not sure

	ADEQUENCY					USE IN TEACHING		
	VA	A	IA	VIA	NS	EFFECTIVELY	RARELY	NEVER
Resources								
Library facilities								
Mathematics textbooks								
Qualified and cooperative t eachers								
Time to learn Mathematics								
Class size (No. of learners)								
Time to learn Mathematics								
Class size								
Measuring tools								
• Abacus • Cubes • Braille papers								

I. Suggest ways of improving the adequacy of resources on the school.

_____

_____

_____

_____

_____

J. How would you rate the following challenges?

Challenges	SA	A	D	SD	N
Luck of skill on tactile Mathematics materials					
Inadequate tactile Mathematics teaching and learning materials					
Time shortage during the lesson					
Syllabus					
Shortage of Mathematics Braille books					
Learning environment					
Mathematics Braille code					
Learners attitude					
Nature of the mathematical content					

K How often do the learners perform the following activities. Please use a tick

Activities	Daily	2-4 days per week	Once per week	Monthly
Class tests				
Homework				
Mark learners homework				
Give individual help to learners				
Allow learners to approach you for help				

L. Which of the following teaching strategies do you adopt while teaching Mathematics?

a. Lecture ( )

b. Discussion ( )

c. Question and answer ( )

d. Others (specify)

_____

_____

_____

_____

M. How would you rate the following factors in relation to learner participation and perfo rmance in Mathematics? (SA= Strongly Agree, A= Agree, D= Disagree, SD= Strongly D isagree N=Neutral

	SA	A	D	SD	N
Teachers attitude					
Parental and societal values and attitudes					
Religious values					
Parental income					
Parental level of education					

N. How would you rate learner's performance in Mathematics in the last 5 years?

VG= Very good, G= Good, F= Fair, P= Poor

APPENDIX III

CONSENT FORM

Title of the project: Relationship between Tactile Materials and Performance in Mathem atics among learners in Thika School for the blind, Kiambu County, Kenya. This research has been approved by the National Commission for Science Technology and Innovation I nstitute. Thank you for your interest in taking part in this research. Before you agree to take part, the researcher must explain the project to you. If you have any questions arising from the explanation already given to you, please ask the researcher before you decide to join in. You will be given a copy of the consent form to keep and refer to at any time.

Participant's statement

I…….Have read the terms and understand what the study inv olves.

Signature …….. Date……

…

APPENDIX IV

CONFIDENTIALITY FORM

Title of the study: Relationship between tactile materials and performance in Mathemati cs among learners in Thika high school for the blind Kiambu county Kenya.

Purpose of the study

The purpose of the study will be to establish the relationship between tactile materials on performance in Mathematics. This information will help those in charge to improve math education.

This information will be treated with confidentiality and only used for the purpose of this study.

.

Signature of the respondent……

Signature of research …….. Date……

APPENDIX V

AUTHORIZATION LETTER

NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email:dg@nacosti.go.ke
Website: www.nacosti.go.ke
when replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/16/45715/14921**

Date:
8th December, 2016

Loise Mumbua Musango
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Relationship between tactile materials and performance in mathematics among learners in Thika High School for the blind, Kiambu County, Kenya,"*** I am pleased to inform you that you have been authorized to undertake research in **Kiambu County** for the period ending **7th December, 2017.**

You are advised to report to **the County Commissioner and the County Director of Education, Kiambu County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Kiambu County

The County Director of Education
Kiambu County

National Commission for Science, Technology and Innovation is ISO 9001:2008 Certified

APPENDIX VI

RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MISS. LOISE MUMBUA MUSANGO
of KENYATTA UNIVERSITY, 4001-1002
THIKA,has been permitted to conduct
research in *Kiambu County*

Permit No : NACOSTI/P/16/45715/14921
Date Of Issue : 8th December,2016
Fee Recieved :Ksh 1000

on the topic: *RELATIONSHIP BETWEEN TACTILE MATERIALS AND PERFORMANCE IN MATHEMATICS AMONG LEARNERS IN THIKA HIGH SCHOOL FOR THE BLIND, KIAMBU COUNTY, KENYA*

for the period ending:
7th December,2017

.....
Applicant's Signature

.....
Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officer will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

Serial No.A 12280

CONDITIONS: see back page

APPENDIX VII

MAP OF KIAMBU COUNTY