FACTORS INFLUENCING PERFORMANCE IN MATHEMATICS AMONG LEARNERS WITH LOW VISION IN INTEGRATED PUBLIC PRIMARY SCHOOLS IN NAIROBI COUNTY, KENYA

BY

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Factors influencing performance in
DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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This work is dedicated my beloved husband Solomon and my three children Rachael, Ian and Ann whose support enabled me to pursue the course at this level.
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ABSTRACT

The purpose of this study was to investigate performance in Mathematics among learners with low vision in integrated public primary schools in Nairobi County. The study adopted a descriptive research design and survey methods. The researcher targeted learners with low vision without other disabilities in classes 4 to 8, their teachers of Mathematics, deputy headteachers and headteachers as the respondents in order to gather information for the study. Two questionnaires, an interview guide and two observational checklists were used to collect information. Test-retest method was used to ascertain the reliability of the research instruments. The quantitative data was analyzed using means, standard deviations, frequencies and percentages. The results for the analysis were then presented using tables, pie chart and graphs to identify variable frequencies, averages or ranges in the data extracted from the survey instruments. Qualitative data was summarized in narrative form. The findings of study were that low vision learners had a negative attitude towards Mathematics which did not differ across gender. The study established that the major reasons that make learners with low vision dislike Mathematics were: lack of motivation, negative attitude due to peer influence, teachers of Mathematics not using appropriate teaching/learning materials and family problems. Majority of learners used mounted spectacles magnifiers when studying Mathematics. However, in the two selected schools, very few environmental modifications were done. The classrooms had adapted desks and learners were given preferential seats although the classrooms were congested with 48 to 55 pupils per class. Teachers of Mathematics were observed spending very little time interacting with learners regarding individual attention and encouraging them to succeed in Mathematics. On the basis of these findings, the study recommended that the Kenya government through the MOE, NGOs and parents to give priority towards the provision of adequate instructional materials for teaching and teachers should be in-serviced in the use of individualized education programme. The researcher also recommended that, a fund be set aside for modifying the environment by the government and be increased in all integrated public primary schools. Teachers should also be motivated to concentrate on assisting learners with low vision to make use of their private time.
ABBREVIATIONS AND ACRONYMS

C.R.E  Christian Religious Education
CBM  Christoffel Blinden Mission
DSSO  Disabled Students Service Office
ICEVI  International Council for the Education of the Visually Impaired
JICA  Japan International Cooperation Agency
K.C.P.E  Kenya Certificate of Primary Education
K.N.E.C  Kenya National Examination Council
KIE  Kenya Institute of Education
KISE  Kenya Institute of Special Education
L.V  Low Vision
LVD’s  Low Vision Devices
MOE  Ministry of Education
NGO’s  Non-Government Organizations
P.C.E.A  Presbyterian Church of East Africa
PI  Primary Teacher Level 1
SMASE  Strengthening Mathematics and Science Education
UNESCO  United Nations Educational Scientific and Cultural organization
V.A  Visual acuity
V.F  Visual field
V.I  Visual Impairment/visually impaired
WHO  World Health Organization
CHAPTER ONE
INTRODUCTION AND BACKGROUND OF THE STUDY

1.0 Introduction

Discussed in this chapter is the background of the study, statement of the problem, purpose, objectives, research questions, significance, scope, limitations, delimitations, theoretical framework, conceptual framework and definitions of terms.

1.1 Background to the study

Education is a vital and a pervasive force in all aspects of life of an individual and society (UNESCO, 1990). As enshrined in article 26 of the Universal Declaration of Human Rights (1948) and as quoted by Okot, Eron, and Kutosi (2000), everyone has the right to education which shall be free and compulsory without discrimination of any kind. This forms an important basis of education for all children in the world regardless of disability. For centuries, professionals have recognized that individuals with visual impairments need specialized schools to learn well. However, the way that instruction is provided in Mathematics among learners with low vision (LV) has evolved significantly. This evolution is not reflected in their performance due to factors related either to lack of devices, attitudes and/or environmental adaptations (Friend, 2008).

In the latter half of the twentieth century, there was a radical shift in the development of methods used to teach learners with LV in contrast to the earlier practice of sight saving for these learners in America (Heward, 1993). Informed ophthalmologists and educators began to question the validity of saving vision in United State of America. In 1954, the National Association for persons with visual impairments was formed to aid learners with LV. Sight-saving classes were disbanded in favour of programmes that emphasized using
available vision in the more developed world like Britain and America. In 1992, the International Council for the Education of People with Visual Impairments (ICEVI) held a consultative seminar with WHO on the management of persons with LV in Bangkok, Thailand in Asia. That was where a working definition of LV was developed. It is good at this outset to point out that partially sighted and partially blind were the commonly used terms instead of LV.

In other developing countries, children with visual impairments are taught in residential schools. This is particularly true in Africa where in Tanzania and Uganda, programmes of integrated education are still being developed (Kimani, 2002. However, Kenya being a developing country, its Ministry of Education (MOE) through Kenya Integrated Education Programme (KIEP) is encouraging integrating children with disabilities including learners with LV into the mainstream rather than having special schools for them. This was a recommendation of Kamunge Report (1988) which aimed at increasing their performance in Mathematics while mitigating factors that hinder their acquisition of skills in this subject. Learners with LV were to be integrated in regular primary schools and be provided with facilities and equipment including LV devices to enable them learn and perform effectively in Mathematics.

Integration education system was started so as to allow learners with disabilities to learn together with learners without disabilities (Hayes, 1989). According to the Kenya Society for the Blind (2009), the Kenya Integrated Education Programme (KIEP) is an on going project. It began in 1989 in partnership with Kenya Society for the Blind (KSB), Sight Savers International and Ministry of Education (MOE). KIEP is currently operating in 82
districts covering 19 programmes that target children with visual impairments in mainstream schools where they learn alongside the sighted children (KSB, 2009).

Learners with LV have different diverse needs and therefore cannot be dealt with as one group (Kimani, 2002). The World Health Organization (WHO) uses visual acuity (VA) and visual field (VF) as the criterion of categorizing persons with visual impairments. The LV project in Kenya was established in 1994 and Christoffel Blinden Mission (CBM) of Germany sponsors it. It is based at the PCEA Kikuyu Hospital as a department of the Eye Unit. CBM is a Non-Governmental Organization involved in prevention of blindness throughout the developing countries. CBM helps to improve their performance in various subjects including Mathematics in schools. It provides support for children in schools for persons who are blind and those with LV. It also promotes optical workshops, which produce low cost spectacles. Sight Savers International supports most of the integrated programmes in East Africa (Kimani, 2002).

In 1994, the LV project conducted a survey in six residential special primary schools for the VI and in two integrated programmes. The survey established that only about 67% of these VI had low vision, 30% were totally blind and 3% did not qualify to be in these schools since they had normal vision (Kimani, 2002). According to 2009 Kenyan Census Statistics, there are 331,594 visually impaired persons; 153,783 males and 177,811 females in Kenya. This represents about one per cent (1%) of the total population and about four percent (4%) of persons with disabilities whose factors related to their performance in various subjects in schools including Mathematics which should be investigated (Government of Kenya, 2010). The child with LV has experiences that are
different from the child who is totally blind. Teachers of Mathematics are in unique position to observe and detect unusual characteristics in a learner with LV. This is because the classroom setting is the one where children concentrate in a variety of tasks requiring both near and distance visual skills (Rukwaro and Kimani, 2007).

However, children with LV have poor academic achievement even if they use large type of prints. Bala and Bhaskara (2004) indicate that learners with LV are noted to be retarded by at least one to two years and are found to be under-achievers. The vision impairment is the main factor for slower acquisition of information by observation. Bala and Bhaskara (2004) further point out that learners with LV have a slower reading rate and lack concreteness in instructional procedures. Aims and objectives of Mathematics are the guiding star when teaching the subject. They provide direction to the teachers and learners. The objectives as stated in the primary Mathematics syllabus by KIE (2002) are to; (a) acquire understanding of numbers and numeration, (b) develop ability to perform the four basic operations, (c) develop skills in measurement, approximation and estimation, (d) develop spatial concepts and ability to use them, (e) acquire the technique of collecting, representing and interpreting data, (f) develop positive attitudes towards Mathematics and to make good use of leisure time, and (g) develop techniques of investigation and problem solving strategies.

The relationship between attitudes and performance is reciprocal (Aiken, 1970). Attitudes affect performance and performance affects attitudes. He refers to this relationship as a dynamic interaction between feeling and behaviour as observed in performance. Literature underlines that primary teachers often have negative attitudes towards
Mathematics (Pezzia and Martino, 2011). Kenya’s MOE Inspectorate Report (1988) on improving Sciences teaching in schools and colleges identified negative attitudes towards Mathematics as one of the causes of poor performance in Sciences and Mathematics. Teachers play an important role in helping to adjust learners’ handicap and in assisting the other children to accept it either through personal example or modifying attitude more directly (Ndirangu, 1996).

Due to a continuous national poor performance in Mathematics in primary schools, the Kenya government, through the MOE and in collaboration with Japan International Cooperation Agency (JICA) is offering Strengthening Mathematics and Science Education (SMASE) course, Mathematics skill training to all teachers teaching this subject in classes six, seven and eight in primary schools. This Mathematics course was launched in 2009 and is taking five years up to 2013. This is in a bid to achieving vision 2030 goal in education (GOK, November, 2008).

Moreover, mastering Mathematics can be daunting for many children, but researchers have found that children with visual impairments face disproportionate challenges learning Mathematics and by the time they reach the college level, they are significantly under-represented in science and technology disciplines (Science Daily, April 16, 2010).

Table 1.1: KCPE results for four years (2007, 2008, 2009, 2010 and 2011) in Thika Primary School for the Blind.

<table>
<thead>
<tr>
<th>YEARS</th>
<th>ENGLISH</th>
<th>KISWAHILI</th>
<th>MATHS</th>
<th>SCIENCE</th>
<th>SOCIAL STUDIES/CRE</th>
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<tr>
<td>2007</td>
<td>55.22</td>
<td>58.07</td>
<td>39.52</td>
<td>52.89</td>
<td>51.22</td>
</tr>
<tr>
<td>2008</td>
<td>52.12</td>
<td>59.64</td>
<td>43.76</td>
<td>45.80</td>
<td>51.24</td>
</tr>
<tr>
<td>2009</td>
<td>41.72</td>
<td>52.83</td>
<td>36.96</td>
<td>42.8</td>
<td>42.09</td>
</tr>
<tr>
<td>2010</td>
<td>48.57</td>
<td>49.25</td>
<td>39.39</td>
<td>48.8</td>
<td>46.8</td>
</tr>
<tr>
<td>2011</td>
<td>54.81</td>
<td>54.77</td>
<td>39.97</td>
<td>43.03</td>
<td>52.84</td>
</tr>
</tbody>
</table>

From Table 1.1, the results indicate that performance in Mathematics is the poorest when compared to that in other subjects. This implies that, despite the crucial role that Mathematics plays in each individual’s everyday life, factors related to poor performance in this subject by learners with LV have not been sufficiently addressed through research (Sudhir & Ratnalikar, 2003).

The causes of poor performance in Mathematics in Nairobi primary schools may not have been fully identified (Adera, 2004). He further stated that, due to this poor performance every beginning of the year when results were out, the various interested parties like parents, pupils, teachers and administrators usually blame each other. Teachers were blamed for poor quality teaching. Parents and administrators complain that some teachers don’t love that job; hence, they have low morale and negative opinions towards teaching Mathematics in particular. Although the Kenya government has made efforts to assist learners with visual impairments to acquire education, very little has been done to the
quality of overall instruction of persons with visual impairments (Mugo, 2007).

All in all, Mathematics plays a rapidly increasing role as a universal language for science. Without it, science and technology cannot address the complex issues facing the modern world. Thus, unless a country or a group of countries are well equipped with the necessary mathematical skills and knowledge to unlock its enormous scientific and technological potentials, they will be lagging behind in the race of development (Makinde, 2011). It is in this context that the researcher was prompted to investigate factors influencing performance of learners with LV in Mathematics in integrated public primary schools in Nairobi County.

1.2 **Statement of the problem**

Mathematics is a compulsory subject in both primary and secondary schools in Kenya. However, its poor performance in Kenya national examinations year in year out, remains a serious concern for teachers of Mathematics, parents, curriculum developers and the general public (Njoroge, 2011). Persistent failure in Mathematics by pupils with disabilities at the primary school level accounts for the low choice of the subject at the secondary school level. This also leads to low access of science and technology courses at the University by this group of pupils (Wawire, Elarabi and Mwanzi, 2009). Kenya like all developing countries, look to Science and Technology for development (Makinde, 2011). If persons with visual impairments who constitute about 1% of Kenya’s population (GOK, 2010) are thus unrepresented in Science and Technology, then Kenya will be lagging behind in the race of development.
Majority of the primary schools in Kenya perform poorly in their final exam in Mathematics (Akoth, 1992; Njoroge, 2011; Sudhir and Ratnalikar 2003)). In Kenya, learners with disabilities including learners with LV perform even worse than regular learners (KNEC 2011; 2010; 2009; 2008 and 2007). Researchers have recommended a study in the area of Mathematics to establish factors leading to poor performance in the subject (Adera, 2004; Kimaku, 1996 & Mugo, 2007).

Despite Mathematics being an important subject in our life, many children who are VI leave class eight and even some drop out before completing primary cycle without any Mathematics skills required for life interactions. These Mathematics skills include; problem-solving, computation, communication, manipulative and thinking skills to name but a few. To add on to this, many of these pupils who finish their primary school level have no one to follow them up. Thus they end up in the streets begging in order to eke out their living. In light of the foregoing background, this study sought to address factors that influence performance in Mathematics among learners with LV at Kilimani and at Our Lady of Mercy Shauri Moyo integrated public primary schools in Nairobi County for the purpose of increasing their educational and vocational opportunities.

1.3 Purpose of the study

As has been pointed out, several studies have found out that majority of the primary schools in Kenya perform poorly in their final examinations in Mathematics. The study sought to investigate factors influencing academic performance in Mathematics among learners with LV in integrated public primary schools in Nairobi County.
1.4 Research objectives

Objectives of the study were as follows:

1. To determine attitudes of learners with low vision towards learning Mathematics in integrated public primary schools.

2. To establish low vision devices (LVDs) used by the learners with low vision to study Mathematics in integrated public primary schools.

3. To find out about environmental adaptations/modifications necessary for learners with low vision when studying Mathematics in integrated public primary schools.

4. To identify instructional methods and materials used by Mathematics teachers to teach learners with low vision in integrated public primary schools.

5. To determine teachers’ attitudes towards teaching Mathematics to learners with low vision in integrated public primary schools.

6. To give suggestions that can be used to minimize Mathematics academic difficulties among learners with LV.

1.5 Research questions

1. What were the attitudes of learners with low vision towards learning Mathematics in integrated public primary schools?

2. Which were the low vision devices used by learners with low vision when learning Mathematics in integrated public primary schools?

3. Which environmental adaptations/modifications were available for learners with low vision when studying Mathematics in integrated public primary schools?
4. Which instructional methods and materials were used by Mathematics teachers to teach learners with low vision in integrated public primary schools?

5. What were the teachers’ attitudes towards teaching Mathematics to learners with low vision in integrated public primary schools?

6. What were the suggestions that could be used to minimize Mathematics academic difficulties among learners with low vision?

1.6 Significance of the study

Mathematics is an important subject in Kenya schools and it has become a major determinant of the future careers to be undertaken by pupils. Performance in Mathematics by pupils at national and local examinations causes a lot of concerns among parents, teachers, schools and other educational administrators in Kenya. The findings of this study may be beneficial to policy makers, educational administers, teachers of Mathematics educating learners with LV in schools and any other persons dealing with such learners in the communities and society as a whole.

Policy makers

Curriculum planners and developers may benefit from the findings of the study in the development of adapted Mathematics curriculum and making the Kenya education system more accommodative to learners with LV to cater for their diversity.

Educational administers

Educational administers are in charge with the responsibility of monitoring learning programmes in schools. The findings may help them to redesign appropriate methods of teaching that may motivate pupils with LV to like Mathematics.
Teachers of Mathematics

The findings may help teachers in identifying learners with LV through their behavioral characteristics highlighted in the study.

Furthermore, the study may assist the special teachers of learners with LV and other interested persons in making referrals of children with LV for further assessment and appropriate placement.

Finally, the findings of the study may also be helpful to teachers of Mathematics in integrated public primary schools by offering them various suitable Mathematics instructional methods that may enhance learners with LV in performance in the subject.

Learners with low vision

The findings may help the learner to develop positive attitudes towards Mathematics subject and their teachers of Mathematics.

1.7 Scope, limitations and delimitations

The study was conducted in Nairobi County, focusing on integrated public primary schools for the children who are visually impaired. The selected schools were Kilimani and Our Lady of Mercy; Shauri Moyo integrated public primary schools. Nairobi County has three integrated public primary schools for learners with LV (KSB, 2009). The third school was Muthaiga which was the piloting location.

1.7.1 Limitations of the study

The study was limited due to lack of previous studies addressing similar concerns, and
the availability of relevant literature on from Kenya and other developing countries pertaining to factors influencing performance of Mathematics among learners with LV. The review was basically drawn within and outside Kenya.

The study was also limited to only one county, Nairobi, the capital city of Kenya. This means that the results cannot be generalized to other integrated public primary schools in other Counties. For more conclusive result, more urban counties could have been studied. However, this was not possible due to financial and other constraints.

1.7.2 Delimitations of the study
The study was delimited to learners with LV with no additional disability in classes 4 to 8, their teachers of Mathematics, deputy head teachers and headteachers who were included in the sample and those present in the sessions in their respective schools by the time of study.

The study was based on learners with LV with no additional disability in classes 4 to 8 in integrated public primary schools who were the direct beneficiaries of the educational provision.

1.8 Assumptions of the study
The study was based on various assumptions, namely:

There were no intervening variables when the learners were being taught Mathematics.

There was mismatch between methods of teaching Mathematics to learners with LV
and performance in the national examinations.

There was cooperation among most respondents in giving accurate information on learners with LV performance in Mathematics.

1.9 Theoretical framework

The study was based on Piaget’s theory of cognitive development (1985). The theory states that thinking process change radically though slowly, from birth to maturity. This is because we constantly strive to make sense of the world through biological maturation activity, social experience and equilibration that interact to influence changes in thinking. Piaget’s many observations convinced him that intellect grows through what he called assimilation and accommodations, where each stage of his theory was age related and consist of distinct ways of thinking. The learners with LV attempt to understand new experiences or solve problems using their current schemas. However, Piaget was not an educator but he provided a sound conceptual framework for viewing learning and education. Teachers of Mathematics who teach learners with LV in an attempt to improve their Mathematics performance could apply ideas in Piaget’s theory.

The theory moreover, emphasizes that a learner with LV has innate active interests around him/her. This interest should be sought in every possible way for him/her to search out answers so as to make his/her own discoveries. The theory further states that, every normal pupil is capable of Mathematical reasoning if attention is directed to activities of his/her interest. By this method, the emotional inhibitions that too often give him/her feelings of inferiority in lessons are removed. Teachers should therefore, set them to interact with the environment and with concrete objects. The learning process in
Mathematics should begin at motor level where the learner deals with concrete objects and then proceeds to the abstract level (Mondoh, 2005). Failure to do this could be the source of much difficulties experienced by older learners with LV in Mathematics.

In addition, the theory suggests that teachers of Mathematics should always bear in mind that a learner with LV interaction with the physical environment could increase the rate of development. For the learner with LV to interact with the environment effectively, the environment should be modified depending on individual needs of each learner. The teachers of Mathematics should ensure there is proper lighting in the classrooms, the learners are given preferential seating and visual displays be modified. By doing so, the opportunity to observe and manipulate objects they are using when learning mathematics will help them to think in more complex ways. Also, the corners of the buildings should be marked with colour yellow to enhance free movements while the learner is in the school and the toilets modified.

The theory further advocates on cultivation of desirable attitudes when teaching Mathematics to learners with LV. Attitudes largely determine what learners learn in Mathematics. They may enhance or hinder the learning of Mathematics. For learners with LV to have positive attitudes towards Mathematics, they should be provided with a variety of special instructional materials which can go along way in developing interests of pupils in the subject. Special instructional materials include; large print Mathematics text books modified visual displays, bold squared exercise books, LV watches, talking clocks, closed circuit television and modified measuring tools like rulers, protractors and pairs of compasses. The provision of these materials will mainly depend on the needs of
the individual learner.

Piaget’s theory stresses that motivation is important to learning for both the teachers of Mathematics and the learners with LV. Teachers of Mathematics should motivate learners with LV by marking their work regularly, giving immediate feedback and rewarding them for any improvement based on individual performance. Provision of appropriate devices, use of relevant teaching/learning materials and use of appropriate teaching methods will also motivate these learners. When a learner with LV is well motivated, he/she will be active throughout a Mathematics lesson, thus developing a positive attitude towards improving the performance in the subject.

Teachers of Mathematics play an important role in helping to adjust learners’ handicap and in assisting the other children to accept it either through personal example or modifying attitude more directly. The theory advocates that the government should ensure teachers of Mathematics attends Mathematics seminars regularly which will update them with the latest state of the art knowledge and skills regarding Mathematics. The government should also ensure enough money is given to integrated public primary schools for purchasing special teaching/learning materials for these learners. Finally, the teachers of Mathematics should be awarded promotions where good performance is noted.

1.10 The conceptual framework

The factors affecting performance in Mathematics among learners with low vision in the Kenya Certificate Primary Education can be drawn from the following conceptual framework.
Figure 1:1 Conceptual framework on factors related to performance in Mathematics among learners with low vision.

Box A

**Independent Variables**

- Low vision devices
- Environmental adaptations
- Effective Mathematics instructional methods
- Marking of books regularly
- Immediate feedback
- Specialized Mathematics teacher
- Positive attitudes of the teacher

Positive attitude of learners with LV

**Dependent Variable**

Improved Mathematics performance

Box B

- Manager
- Engineer
- Teacher
- Accountant

Source: Author’s interpretation from literature review

In Figure 1:1 a learner with LV was motivated by the stated factors in box A resulting him/her to develop positive attitude towards Mathematics subject. A high motivation of the learners with LV creates a high self-perception thus increasing his/her performance and participation in Mathematics lessons. The positive attitudes towards Mathematics lead them to take learning of sciences at secondary school level. This further leads learners with LV to pursue science and technology courses in the university and join good careers in shown in box B.
1.11 Operational definition of terms

Category II: - Refers to those learners with low vision which is not enough to allow them read print. They use braille as a means of reading and writing.

Disability: - The reduced function or loss of a particular body, part or organ.

Integration: - A process through which learners with and without special needs is taught together to the maximum extent possible in a least restrictive environment. The child is expected to adapt to the environment.

Mathematics skill: - Ability to apply Mathematics knowledge of measurement, manipulation, analysis, problem solving, computation and Mathematics positive attitude of being anxious to do and find out.

Non-optical devices: - Devices which do not involve the use of lenses for magnification.

Optical devices: - Lenses placed between the eye and the object to facilitate seeing.

Visual acuity of 20/70: - Means that an eye can see at distance of 20 metres what the normal eye can see at 70 metres.

Visual acuity: - Refers to how clearly one is able to see.

Visual field: - Refers to the area of vision one is able to see when a person is looking straight without turning the eyes or the head.

Visual functioning: - Refers to the ability of a person to perform visual tasks.

Visual impairment: - Is impairment in vision that even after correction, adversely affects a child’s educational performance. The term includes both persons with L.V and blindness.
1.12 Summary of chapter one

The chapter has dealt with the background of the problem whereby the significance of Mathematics as a subject has been discussed from a global as well as a Kenyan perspective. The researcher in this chapter has highlighted the issue of Mathematics in the Kenya primary schools syllabus and its performance over the years by both regular pupils and those with low vision.
CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

Discussed in this chapter are the attitudes of learners with LV towards Mathematics, optical devices and environmental adaptations necessary for learners with LV when studying Mathematics, instructional technology used by teachers in the facilitation of teaching and learning Mathematics by learners with LV and finally teachers' attitudes towards teaching that subject to learners with LV.

ICEVI (1992), working definition of person with LV is, "a person who has impaired visual functioning even after treatment or standard refraction correction, has a Visual Acuity of less than 6/18 in the better eye, or has a Visual Field of less than 10 degrees from the point of fixation, but has a potential of using vision for execution of visual tasks." According to MOE (2009), with special adaptations and appropriate lighting, the child who has LV can function in the general education classroom.

Mathematics is defined as an exact science which is related to measurement, calculation, discovery, relationship and dealing with the problem of space (Sudhir and Ratnalikar, 2003). Mathematics has been the backbone of our civilization. It has led to the development of various subjects' vocational and technological which is playing an important role in various walks of life. The main education aim is to provide the knowledge to the learners including those with LV so that they can become useful citizens in the society. Mathematics is used widely in the teaching and learning of the other subjects in the school curriculum (Indimuli, 2001). The use of Mathematics in
science, technology, history, geography, CRE, music, literature, business and management studies, reflects the central role of Mathematics in many aspects of our lives (Mondoh, 2005).

The child with LV has experiences that are different from the child who is totally blind. Teachers are in unique position to observe and detect unusual characteristics in a learner. This is because, the classroom setting is the one where children concentrate in a variety of tasks requiring both near and distance visual skills (Rukwaro and Kimani, 2007). Total blindness can easily be recognized and identified but a detailed examination is needed to recognize a child with low vision (Bala and Bhaskara, 2004). The Optometric Extension Programme Foundation 2003 as quoted by (Gargiulo, 2006) developed a checklist of observable characteristics of vision difficulties in children to assist teachers in making reliable observations of children’s visual behaviour.

These behavioural characteristics in vision function problems for children who are visually impaired include; (a) holding reading material extremely close to the face, (b) usually turning the head, body or eye, (c) excessive rubbing of the eyes, (d) watery eyes, (e) eye fatigue, (f) frequent eye pain, (g) frequent headaches, (h) squints or shades the eye to view objects, (i) constantly having difficulty in keeping up when reading and writing, (j) using markers such as pencils and fingers when reading, (k) difficulty copying from the board or transparencies, (l) confusion in writing letters and numbers appropriately, (m) flimsy movement from one environment to another, (n) poor posture in both standing and sitting, (o) reluctance to participate in social and physical activities, (p) poor grades, (q) difficulty with colour identification, (r) sensory perceptual coordination, (s) misaligns
columns when writing mathematics problems, (t) require additional time to complete a

task, (u) fails to make eye contact when talking to people, and (v) behaviour problems

(Gargiulo, 2006). Although teachers are in a position to identify learners with LV, many

assume them due to heavy workload which they have, or either they do not want to

involve themselves due to the long process involved before one can succeed to place such

a single child.

2.1 Determining factors for poor performance in Mathematics for learners with LV

This study is concerned with an area in which relatively little research has been done

(Ruto, 1996). Integration of exceptional children into mainstream primary schools has

over the years received some scattered attention in Kenya. This also applies to learners

with LV. However, in the area of Mathematics for learners with LV in integrated public

primary schools, the scholars seem to have waned.

2.1.1 Attitudes of learners with low vision towards Mathematics

Although there is no standard definition of the term attitude, in general, it refers to a

learned predisposition or tendency on the part of an individual to respond positively or

negatively to some object, situation, concept or another person (Aiken, 1970). According

to Njoroge (1991), for integration programmes to function effectively for the benefit of

students with VI in the regular schools in Kenya, the regular education teachers will play

a dominant role in assisting both academic and social success of these students within the

mainstream.
Adera (2004) carried out a study to investigate attitudes of form four students towards Mathematics as a subject in regular public secondary schools and their academic performance in selected schools in Nairobi Province. The study found out that the attitudes of students in regular public secondary schools affected performance as a subject. He also found out that majority of form four students were aware of what they needed to do in order to pass Mathematics, but they still did not perform well. His key recommendation was that students needed to be exposed to peers (especially those from good performing schools) through symposiums and teachers to be exposed to seminars and in-service training. Njoroge (2011) found out that learners that were non-disabled in class six in Nairobi County had negative attitudes towards Mathematics. Throughout the history of the society, disability had been viewed as a contentious issue where the role of cultural values and norms in the development of attitudes had been crucial (Hodkinson & Vickerman, 2009). Therefore, there was need to investigate this issue among learners whose needs were different from those without disabilities. Hence, the study sought to investigate the attitudes of learners with LV towards Mathematics in integrated public primary schools in Nairobi County.

Bottom (1983) conducted a study in the United State of America based on Physics. He stated that attitudes influence cognitive learning. His study compared physics students who liked Physics with those who disliked it. The result of the study indicated that those who disliked Physics tended to perform poorly as compared to students who disliked the subject. The researcher stated that when students’ attitudes are negative towards a particular subject, teachers and everybody concerned with teaching of the subject should
examine and carefully appraise the situation. Since attitudes of learners towards a subject affect the performance, this study investigated attitudes of learners with LV towards Mathematics and other factors leading to its poor performance in integrated public primary schools.

2.1.2 Optical Devices for learners with low vision

Many learners with LV can use compensatory strategies and tools so that print is their primary literacy medium (Friend, 2008). Some learners will use large print materials when learning Mathematics, but then, they can read only when such materials are available. A general education setting is appropriate for many learners with LV. Its appropriateness must be determined on an individual basis, be specific and intervention planned from a professionally VI specialist. According to Chapter 4 item 54 of the Constitution of Kenya, persons with disabilities including those with LV are entitled access to materials and devices to overcome constraints arising from a person’s disabilities (GOK, May 2010).

A study carried out by Jeanier and Morse (2007) in South Carolina, which was designed to increase visual reading skills in students with VI through intensive training and practice, and with prescribed LVDs for near vision, concurred with the findings of (Corn, Wall, Jose, ell, Wilcox & Perez, 2003). They conducted an experimental research using a sample of sixteen (16) students with LV and with VA of 20/70 or worse and the use of large print. All the participants were eligible for and received instructions from teachers of students with visual impairments at South Carolina School for the Deaf and Blind (SCSDB) either in their local public school district or South Carolina School for the Deaf
and Blind. Seven of these students used the large print materials to access the curriculum while the remaining nine students received magnifiers after they had clinical low vision examinations. All participants took oral reading tests using the Basic Reading Inventory (BRI) at the beginning and end of the 2005-2006 school years. Their reading rates and comprehension levels were recorded.

Jeanier and Morse (2007) concluded that students with LV can effectively use magnifiers for reading. Furthermore, they found out that the reading abilities of the magnification group improved more than that of the large print type. The results were so convincing that teachers of students with VI in the division of outreach, routinely recommended LV clinics as opposed to just providing large print materials for LV. However, the two researchers failed to indicate whether the one student whose data was not available, used a near-viewing optical device or a far-viewing optical device. They also fell short of stating the near-viewing and the far-viewing optical devices they used. Near-viewing optical devices include hand held magnifiers, stand magnifiers and spectacle mounted magnifiers. A far-viewing optical device is the telescope. Learning devices are one of the factors considered to be effective for participation of learners with LV in learning in integrated programmes (MOE, 2009). The government should provide learners with special needs with appropriate basic assistive devices needed to access education (Kochung Report, 2003). Hence, the study investigated the actual reading devices that were used by learners with LV in integrated public primary schools in Nairobi County.

2.1.3 Environmental adaptations/modifications for learners with low vision

Environmental adaptations are changes that may be made in the social and learning
environments in order to enhance visual efficiency for persons with LV so as to make the individual operate to as near 'normal' as possible (Gargiulo, 2006). Persons with LV are very much like any other persons and have the same strong desire to take an active part in the class and in the social environment (Kimani, 2002). The visual impairment specialist must carry out a range of activities to ensure that appropriate adaptations and modifications are made in the learning environment and that instructional materials available are based on individual needs (Friend, 2008).

University of Washington (2007) carried out a Mathematics case study about Marika who was a visually impaired student on accommodation for visual impairment. Marika could read large print, but had trouble in seeing the content on a computer screen, especially when the lighting was poor. During Mathematics classes, he had difficulty seeing blackboard or overhead notes written by instructor even when he had front row seating. The Disabled Student Service Office (DSSO) began to make large print copies of his mathematics course. Also, when instructors gave handout, the DSSO would make large prints for him. He talked to all his instructors and they agreed to send his exams in advance to DSSO so that the exams could be enlarged and do them there with extended time. Moreover, if the examination was in multiple choice formats with a scantron answer sheet to complete, assistance in the office would fill in his answers after he completed the examination because he could not see adequately to complete it. Marika could arrive at class early to be sure that he could sit in the front row. Finally, the disabled student service counselor arranged for a note taker, who sat next to him with oversize paper to write in large print any information presented on the board/overhead.
This case study of Marika and Mathematics on accommodation for student who was visually impaired illustrated the following adaptations for them: first, low-tech accommodation like enlarging print materials can easily be provided by the instructors or the DSSO; secondly, simple, straightforward accommodation such as front row seating options, note taking and testing accommodation (extra time) are effective for many students with LV; thirdly, students with visual impairments need to access simultaneously or very quickly, information presented in classes so that they can learn and participate like other students in the class. Lastly, as required under American Disability Act 1990 and Section 504 as quoted by University of Washington (2007), these accommodations are timely and effective with priority consideration given to the communication preferences of the students. In their study, the researcher/researchers failed to provide Marika with talking calculators, low vision watches, tape recorded lectures and closed circuit television (CCTV) which could have enhanced the learning of this subject.

Partners in Disability Forum (2007) which began in 2004 and initiated by Terres Des Hommes of Netherlands and its partners in East Africa brought together teachers, directors from education institutions and parents with disabilities. They shared information that would help and encourage teachers and other professionals in their work for children with special needs from Tanzania, Uganda and Kenya. During this period, lengthy discussions were held in December 2004 on the challenges they face and problems they encounter. In Tanzania the forum found out that both learners who are blind and those with LV get twenty (20) minutes extra in Mathematics examinations. In Uganda the forum observed that learners in special schools get thirty (30) minutes extra
for their examinations. Finally, in Kenya, they found out that students who are blind are given thirty (30) minutes extra time and no extra time is given to learners with LV. However, on print issues, the forum noted that in both Kenya and Tanzania, students with LV are provided with only one size prints which seem to be insufficient no matter each learner’s specific degree of impairment. Colours on paper, lighting and seating position in classroom also affect the performance of students who are visually impaired. However, the study also investigated other factors such as devices they use, environmental adaptations, attitudes and instructional technology that lead to poor performance of learners with LV.

Wakahiga (2009) examined twelve public primary schools with special needs learners in Murang’a County on environmental adaptations using interview schedules. The outcomes were that; learners who are VI were the most comprising 14.6% of those with special needs and few adaptations had been done in the two schools studied where situation differed from school to school. This study noted that the government allocates Ksh 10,000 to every public primary school since 2004 yearly for environmental modifications (Kochung Report, 2003). He noted that there was need to modify the lighting system for learners with visual problems through use of hydro-electric supply or installation of transparent iron sheets on the roofs. He also recommended that funding for environmental modifications are increased by the government and this fund’s auditing be ensured regularly. Kochung Report (2003) further pointed out that learners with LV require a barrier free environment in order to maximize their functional potentials. As indicated above, the researcher noted that learners who are VI were the most among those with disabilities and he failed to recommend a study to investigate other factors that may
be hindering their performance in regular public primary schools to improve on their academic performance such as attitudes, instructional technology and LVDs to mention but a few.

2.1.4 Instructional technology to facilitate of learning Mathematics by learners with low vision

Instructional technology refers to teaching/learning materials and the methods which are suitable for the use of these instructional materials in the facilitation of learning mathematics by the learners who are VI (Mugo, 2007). It is imperative that the strategies for teaching VI be selected carefully. Research in education as referred to the physical capacity of various senses has shown that, people learn and remember more from what they see (Barghoutti, 1973). The use of multi-media approach is recommended in the learning process. Visual displays for persons with VI should be clear, bold and with less details (Kimani, 2002).

A study carried out by Mugo (2007) in both residential and integrated public primary schools for the blind, indicated that teachers teaching visually impaired use a combination of different instructional methods to achieve different types of objectives. The methods he found to be so versatile for use to most types of objectives in the five examinable subjects (English, science, Mathematics, social studies and Kiswahili) in these sampled schools were: assignments, arithmetic calculations, question and answer, peer tutoring, self-exploration exercises, shape identification and class discussions. Other methods include: brainstorming, pile sorting, lecture, competitive games to name but a few.
Mugo (2007) further established that, although instructional methods for teaching the VI are in many ways similar to those for teaching sighted learners, the teachers of VI require extra skills on how to use the materials in the teaching of the VI. He recommended that headteachers/principals that are experienced and trained on how to manage special schools, should head all the schools with integrated programmes and special schools for the blind. This will ease the problem of bureaucracy and dictatorship in these schools and in return enhance the proper acquisition and utilization of instructional methods for the teaching of learners who are VI. According to Randiki (2002), the teachers in the regular classrooms must modify instructional strategies to accommodate learners with LV. Thus, the study investigated instructional technology used by teachers of Mathematics in teaching the subject to learners with LV in integrated public primary schools.

2.1.5 Teachers’ attitudes towards teaching Mathematics to learners with low vision

The knowledge of Mathematics is needed at every step or stage of life. It is possible to do without the knowledge of our mother tongue but life become a hell without the knowledge of calculation (Sudhir and Ratnalikar, 2003). Everybody, irrespective of the part or which class of society he/she belongs, makes use of Mathematics knowledge of percentage, average stock and share, to run his business efficiently. Also various fundamentals of Mathematics such as addition, subtraction, counting, numerals and measurement are used by all of us in our daily life. Therefore, a Mathematics teacher for learners with LV should be a guide, helper and a friend to such learners. He/she must study the child, know the effect of environment on the child and know the laws of learning for which a study of psychology is necessary.
Gitonga (1984) carried a study on attitudes of primary school teachers towards teaching Science subject in Igoji Division of Meru County. The researcher used questionnaires to collect data from the teachers of Science. He found out that seventy four percent of the teachers teaching Science in the sample had positive attitudes towards teaching Science in primary schools. He also found out that Science teaching in primary schools was faced with various problems. The major problem was lack of sufficient materials such as Science textbooks, Science apparatus and materials. Hence, the researcher carried out this study in order to investigate attitudes of teachers towards teaching mathematics to learners with LV in integrated public primary schools.

According to Chorolambous, Panaoura and philippou (2008), abstract scholars and teacher educators alike agree that, teachers’ beliefs and attitudes towards Mathematics are the key informants of teachers’ instructional approaches. They further noted that, in addition to enhancing pre-service teachers’ knowledge, teacher education programmes should also create opportunities for prospective teachers to develop productive beliefs and attitudes toward teaching and learning of Mathematics.

A study conducted by Ndirangu (1996) in Nairobi County on peer acceptance of the child who is VI within the integrated class indicated that, all the teachers involved in the integrated programme have been exposed to the ideal of integration by teaching in integrated classes. Through such activity they had a chance to meet the learners who are VI and also learn more about integration, and so their attitudes may have been influenced positively. However, he fell short of recommending a study to investigate attitudes of
Adera (2004) noted that one of the main reasons for poor performance in Mathematics was negative attitudes towards Mathematics. He further said that the method of teaching Mathematics was very instrumental to changing attitudes and improving its performance which lies squarely on the teachers of Mathematics. Therefore there was need to find out the situation for learners with LV given the challenges teachers of Mathematics were likely to have when teaching them. The study sought to investigate attitudes of teachers of Mathematics towards teaching learners with LV mathematics in integrated public primary schools.

2.4 Summary of literature review

As has been observed in the literature review of this study, it is evident that poor performance in Mathematics is a common problem for most of the learners in the world (Adera, 2004; Njoroge, 2011). It is also evidently clear from the literature review that limited research in the field of Mathematics performance among learners with LV has been done in the Kenyan context. This study therefore, is important as it will attempt to fill the gaps noted in this reviewed literature. That is; to determine attitudes of learners with LV towards learning of Mathematics, to establish in detail the extent to which particular instructional methods and materials favour the teaching of Mathematics, find out the environmental adaptations that have been made for learners with LV and to identify Mathematics special equipment and/or LVDs available for learners with LV in integrated public primary schools and finally, to determine teachers’ attitudes towards teaching Mathematics to learners with LV.
CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

In this chapter, the researcher addressed the following sections: research design, variables, and locale of the study, target population, sampling techniques, instrumentation, pilot study, data collection procedures, methods for data analysis and lastly logistics and ethical considerations.

3.1 Research design

The researcher adopted a descriptive survey design to collect data. A descriptive survey design was deemed appropriate for the study because it enabled the researcher to collect information with ease regarding the factors influencing performance in Mathematics among a sample of learners with LV in integrated public primary schools, their teachers of Mathematics, deputy headteachers and headteachers from Nairobi County. The design also enabled the researcher to collect data from the sample within the group of respondents in order to describe their characteristics using questionnaires, interview guide and observation checklists. A descriptive survey is a method of collecting information about people's attitudes, opinions, habits or any of the variety of education or social issues (Orodho, 2010).

3.2 Study variables

A variable is a concept that stands for variation within a class of objects such as; gender, achievement and motivation (Fraenkel and Wallen, 2010).
3.2.1 Dependent variable

Dependent variable refers to the outcome variable a researcher is attempting to predict (Kombo and Tromp, 2006). The dependent variable in this study was academic performance in Mathematics.

3.2.2 Independent variables

Independent variables are those factors that a researcher chooses to study in order to access their possible effect(s) on one or more other variables (Fraenkel and Wallen, 2010). In this study, the independent variables were environmental adaptations, low vision devices (LVDs), instructional methods and materials, pupils' attitudes towards Mathematics and teachers' attitudes towards teaching Mathematics to learners with LV.

3.3 The locale of the study

The study was conducted at Kilimani and at Our Lady of Mercy; Shauri Moyo integrated primary school programmes. Both schools are located in Nairobi County, the Capital city of the Republic of Kenya. Nairobi County has three (3) integrated public primary schools for children who are visually impaired (KSB, 2009). It borders Kiambu County in the North, Machakos County in the East and Kajiado County in the South. It covers an area of 696 square kilometres. Nairobi County is highly populated with about seven percent (7%) of the persons with visual problems in Kenya. This is according to the Kenya population census statistics in 2009 (GOK, 2010). The study area is cosmopolitan in nature and serves as the business centre in the Republic of Kenya.

Nairobi County was selected because of the following reasons;

The two schools selected from Nairobi County were sponsored by the District Education
Board and they were government maintained. This means that policies made by the government affect these two schools directly.

Nairobi County is the capital city of Kenya and thus has a good transport and communication network. Due to the good transport and communication network of the city, the two schools were accessible by parents especially those who lived in or near the city. By this fact, the population of both learners with LV and teachers were quite considerable. This helped the researcher to access enough learners with LV and teachers who taught them Mathematics.

Nairobi County had an advantage of being accessible to the researcher since she comes from the neighbouring county of Kiambu. Kilimani integrated public school is located to the West of Nairobi city about two kilometres away from the city centre while Our Lady of Mercy, Shauri Moyo is located about the same distance East of the city. This enabled the researcher to obtain maximum cooperation from the two schools administration, teachers and learners with LV in the selected schools.

3.4 Target population

The target populations for the study were all teachers of Mathematics teaching learners with LV in classes four to eight, all learners with LV without other disabilities in classes four to eight, all headteachers and all the deputy headteachers in the two integrated public primary schools in Nairobi County.
3.5 Sampling techniques and sample size

Sampling as used in research refers to the process of selecting the individuals who will participate in a research study (Fraenkel and Wallen 2010).

3.5.1 Sampling techniques

Kombo and Tromp (2006) note that, the power of purposive sampling lies in selecting information rich cases for in-depth analysis related to the central issues being studied. Hence, the two integrated public primary schools were selected using purposive sampling due to the fact that the statistics from the City Education Officer (CEO) in Nairobi showed that they had registered the highest number of learners with LV. From the sampled schools, all the twenty (20) learners with LV without other disabilities from classes four to eight, all their fifteen (15) Mathematics teachers and the two (2) head teachers were selected as the dataset was small. The researcher used simple random sampling to select one deputy headteacher per school. The researcher in this case tossed a coin to choose one. The one who picked the head from the tossed coin participated in this study.

3.5.2 Sample size

A sample is any part of a population of individuals on whom information is obtained. It may, for a variety of reasons, be different from the sample originally selected (Fraenkel and Wallen, 2010). Since the research involved a descriptive survey design, all the classes which had learners with LV without other disabilities were used. A sample of twenty (20) learners with LV in classes 4-8, their fifteen (15) teachers of Mathematics, two (2) deputy headteachers and two (2) headteachers were selected. The entire sampling
matrix yielded a total sample size of thirty nine (39) participants for this study.

Table 3.1: Study sample frame

<table>
<thead>
<tr>
<th>Schools</th>
<th>learners with LV</th>
<th>Maths teachers</th>
<th>Head teachers</th>
<th>Deputy head teacher</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Kilimani</td>
<td>11</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Our Lady of Mercy</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>7</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

N = 39

3.6 Construction of research instruments

The data was gathered using questionnaires, interviews, checklists and a classroom observation schedule. The researcher used 5 instruments which supplemented each other in terms of information collected in order to reduce the amount bias created by use of a single research instrument. The instruments were based on the stated objective of the study.

3.6.1 Questionnaires

Questionnaires were found to be appropriate in this study because of the ease with which they were used to collect information from learners with low vision regarding their performance in Mathematics in the selected integrated public primary schools in Nairobi County. Questionnaires are widely used in research as it is possible to give similar or standardized questions to the respondents (Berliner, 1973). This made it possible to compare responses from different respondents on the same questions. By using questionnaires the researcher guaranteed anonymity of the respondents and therefore,
encouraging them to give honest responses. This consequently increased the reliability of the instruments.

3.6.1.1 Questionnaires for teachers of Mathematics

In the study, fifteen (15) questionnaires were administered to teachers of Mathematics to collect information on instructional methods they use while teaching learners with LV and also their attitudes towards teaching Mathematics to these learners. Questionnaires used helped the researcher to save time since all the fifteen respondents were issued with the questionnaires at the same time. Questionnaires for teachers of Mathematics (Appendix A) were constructed in normal print. There was no teacher of Mathematics with blindness. The questionnaires had four open-ended and six closed items. The open-ended items gave the respondents a greater freedom to express their ideas, opinions and suggestions while the closed items enabled the researcher to get specific responses.

The questionnaire for teachers of Mathematics was divided into three parts. Section A asked questions about the teacher, such as gender, years of teaching experience, other subjects taught and their attitudes towards teaching Mathematics to learners with LV. Section B contained 17 teaching strategies used in Mathematics (mentioned in the literature) as helpful techniques in promoting Mathematics. They were derived from a review of the literature carried out by Rukwaro and Kimani (2007) and Mugo (2007). Teachers were asked to rate their familiarity with these strategies on a scale of; 1 (very familiar), 2 (familiar), 3 (neither familiar nor unfamiliar), 4 (unfamiliar) and 5 (very unfamiliar). In section C, teachers were asked to list five strategies which they believed to be the most effective means of including pupils with LV in the their classes as they taught them, to list any strategies they use which may not have been included in the
questionnaire and finally to give suggestions which they thought might improve academic performance in Mathematics for learners with LV.

3.6.1.2 Questionnaires for learners with low vision

Questionnaires were given to twenty (20) learners with LV without other disabilities. These were meant to collect data to determine their attitudes towards learning Mathematics in integrated public primary schools. It was appropriate because the researcher was able to administer the 20 questionnaires at the same time, thus saving time.

Questionnaires for learners with LV (Appendix B) were constructed in large print for ease of reading. There was no learner with LV in category II. If there were any, the researcher would have produced their questionnaires in brailled version. These would have made it easier and more comfortable for those who would not read print copies to read the brailled copies and respond accurately to the items in the questionnaire. The questionnaires for learners with LV had three open-ended and six closed items. The open-ended items gave the respondents a greater freedom to express their ideas, opinions and suggestions while the closed items aimed at getting specific responses.

The questionnaire was divided into three parts. Section A asked questions about the pupil such as class, age, gender, the highest level of education of their parent(s) or guardian. Section A also had a five likert-scale with items to measure pupils’ attitudes towards Mathematics and its importance. The five likert-scale had seven (7) statements which were derived from a review of the literature carried out by Simon and Schifter (2007)
mentioned in chapter two and finally, the career pupils preferred to be in. Pupils were asked to rate their attitudes towards Mathematics with these seven statements on a scale of; SA (strongly agree) A (agree), UN (undecided), DS (disagree) and SDS (strongly disagree). Section B contained ten (10) reasons that make boys and girls with LV dislike Mathematics. They ticked the appropriate reasons which were based on gender. In section C, learners with LV were asked to list two other reasons which were not mentioned in section B which make boys and girls dislike Mathematics. Lastly, they were asked to give suggestions on what can be done to improve their Mathematics performance.

3.6.2 Interview schedule

In the study, interview schedules were used to collect data on environmental adaptations that had been made available for learners with LV in integrated public primary schools in the following areas; classrooms, compound, visual displays and toilets. Using interview schedules the researcher was able to clarify questions that were obscure to the respondents. The researcher was also able to ask the two respondents to expand on answers that were particularly important.

The interview schedule for the headteachers (Appendix C) had three tightly-structured questions requiring specific answers and eight open-ended questions to facilitate discussions with the use of prompts and probes to further explore issues raised. Thus, two interview schedules were constructed for the two headteachers in the selected integrated public primary schools. It was a face-to-face interview during the study. This way, the researcher had a high degree of control of data collected and achieved a higher response rate.
3.6.3 Observation checklists

Observation checklists were appropriate in this study as the researcher gathered data on instructional materials that were actually used by teachers of Mathematics, the way they manipulated them and the way learners with LV coped with the materials and methods used by the teachers of Mathematics. They were used to supplement the information on the questionnaire and to ascertain whether what the researcher observed in the classrooms, lined with what was indicated in the questionnaire. Observation is a very direct method which provides the researcher with close contact with the participants or events being studied. It ensures an enabling ‘real life’ picture to be achieved (Grosvenor and Rose, 2001). The researcher used non-participant approach whereby she attempted to be ‘fly on the wall’ in the classroom, sat at the back and took field notes. The researcher followed a rigid structure and carried a formal observation checklist which indicated precisely what she intended to record. Two checklists were filled.

The first one contained all the possible instructional materials (Appendix D) that would be in use in teaching Mathematics to the learners with LV in upper primary level. The researcher obtained these instructional materials from related literature in the study and also from the internet to compare with what is used in Kenya with those in use in other countries of the world.

The second one was a classroom observational checklist (Appendix E) which contained items focusing on how teachers of Mathematics for learners with LV use instructional materials and methods to teach them. The 17 items on instructional methods were derived from a review of the literature carried out by Mugo (2007). Classroom observations are
mostly reliable when they are conducted over a period of time or on more than one occasion so as to minimize the chances of the observation lesson being atypical (Wilson, 2009). Thus the researcher used three (3) classroom observation checklists in the first school which were the only classrooms with learners with LV and eleven (11) classroom observation checklists in the second school to observe Mathematics lessons in upper primary classes in the selected integrated public primary schools in Nairobi County. The researcher noted that some classes had no learners with LV. Thus she only observed those classrooms where learners with LV were present in classes four to eight. The classroom observational checklists information was used to supplement the information collected on the questionnaires. It also ascertained whether what the researcher observed in the classroom was in line with what was indicated in the questionnaires.

3.7 Pilot study

The researcher piloted the questionnaires with a small representative sample identical to, but not including the group in the actual survey at Muthaiga integrated public primary school. The researcher used two learners with LV without other disabilities, one teacher of Mathematics teaching these learners, one headteacher and one deputy headteacher during piloting. The researcher was assisted by the head of the department of persons with visual impairments to conduct the piloting. The following steps were employed (Orodho, 2010); (a) the developed questionnaires were given to five identical respondents who were not included in the actual study sample, (b) the completed questionnaires were scored manually, (c) the same questionnaires were given to the same respondents after a two weeks lapse, (d) the completed questionnaires were again scored manually, and (e) a
comparison of answers made in (a) and (d) were analyzed.

The practice of pre-testing the questionnaires was important because unclear directions, insufficient space to write the responses, clustered questions and wrong phrasing of questions were detected. Secondly, vague questions were revealed in the sense that the respondents interpreted them differently. For example, before piloting the interview schedule for the headteacher, it had three tightly-structured questions and nine open-ended questions, but after piloting open-ended questions reduced to eight. Finally, the results of the study enabled the researcher to have an idea of the kind of results to expect.

3.7.1 Reliability

Reliability of an instrument is the consistency in producing a reliable result (Orodho, 2010). The researcher used test-retest method to ascertain reliability of the research instruments. The developed questionnaires were given to the selected sample. After two weeks lapse, the researcher administered the same questionnaires to the same group of participants. Spearman Rank Order Correlation (rho) was employed to compute the Correlation Coefficient (r) in order to establish whether the contents of questionnaires have consistency in eliciting the same responses every time the instrument is administered. A Correlation Coefficient of 0.8 was obtained which was considered high enough to judge the reliability of the research instruments.

3.7.2 Validity

Validity is the degree to which the empirical measure or several measures of the concept, accurately measure the concept (Kombo & Tromp, 2006). Therefore, for the purpose of
this study, the researcher pointed out a panel of three judges who were competent in the area being investigated. The researcher wrote out the definition of what she wanted to measure and then gave it along with the instrument and a description of the intended sample to these judges to assess the relevance of the content used in the questionnaires developed. They examined the questionnaires individually and provided feedback to the researcher. Their recommendations were incorporated in the final questionnaires. After piloting and making the necessary amendments, the researcher carried out an evaluation of the revised questions. That included finding out if the questions were clear and specific, where the key questions were placed and if the balance of questions was correct.

3.8 Data collection procedures

The data were directly collected by the researcher in a period of four weeks. Initial contact was first established by visiting the Provincial Director of Education and Provincial Commissioner Offices in Nairobi County to deliver the copies of the permit and inform them about the purpose of the study. Mathematics teachers were observed while teaching learners with LV in the sampled classes. The researcher observed three (3) classroom observation sessions in the first school and eleven (11) classroom observation sessions in the second school of Mathematics lessons in upper primary classes in the selected schools. The researcher noted that some classes had no learners with LV. Thus she only observed those classrooms where learners with LV were present in classes four to eight. Hence, a total of fourteen (14) sessions was observed. During the classroom observation sessions, the researcher sat at the back of the classroom and observed the progress of the lesson. The classroom observation checklist indicated the instructional materials that were actually used by the teachers of Mathematics, the way the teacher
manipulated the instructional materials to teach the pupils and also the way pupils coped with the materials and methods used by the teachers.

The researcher first observed classroom sessions because it enabled her to obtain accurate data on the instructional materials and methods used by teachers without their prior knowledge of the intention of the study. The information obtained through classroom observation supplemented the responses on the teachers’ and pupils’ questionnaires. The second study instrument administered was teachers’ questionnaires. After explaining the purpose of the study to the teachers, they were supplied with questionnaires to fill at their convenience by the researcher. Thirdly, the observation checklist for resources and materials were filled by the researcher in the library/store. She was assisted by the deputy headteacher to record available Mathematics teaching and learning resources as he/she is in charge of inventory in the school store. Fourthly, pupils’ questionnaires were administered by the researcher. With the help of the head teacher and the departmental Head of children who are visually impaired, the class four to eight pupils with LV without other disabilities were put in one group in a separate room to facilitate the administration of the questionnaires. The researcher distributed the questionnaires among the pupils with LV, explained the importance of the research and collected the questionnaires after the pupils had completed filling them. The fifth and the last study instrument administered by the researcher was the headteachers’ interview schedule guide which was a face-to-face interview.

3.9 Data analysis

The researcher read through completed questionnaires, interview guide schedules and
observational checklists noting any response that was not applicable. Data analyses
depend on the type of data collected. For qualitative data from interview schedules and
observational checklists, the researcher coded and analyzed them manually since they
were few. The researcher read and coded both semi-structured questions and structured
questions from the interview schedules and observational checklists in relation to the
kinds of answers, themes and issues and categories of response, watchfully keeping a
note of what the codes refer. Data for qualitative data was analyzed using descriptive
statistics such as tables, frequencies and percentages.

Quantitative (survey) research data were collected from population of 20 learners with
LV without other disabilities in classes 4 - 8 and their 15 teachers of Mathematics using
two questionnaires. Quantitative data (categorical data) to determine attitudes of learners
with LV towards Mathematics and data on instructional strategies used in teaching the
subject in the study were analyzed using the statistical analysis software (Statistical
Package for Social Sciences, SPSS Version 11.0 for windows). Statistical Package for
Social Sciences was used to calculate the mean and standard deviations of the data
collected. Data for quantitative data was analyzed using descriptive statistics such as
mode, mean, standard deviations, bar graph, tables, frequencies and percentages. To
determine whether learners’ attitude towards Mathematics differed across gender and
whether parents’ level of education had an impact towards pupils’ attitude in
Mathematics the researcher used Chi-square tests.
3.10 Logistical and ethical considerations

Before the researcher went to the field, she obtained a research permit from the National Council for Science and Technology authorizing her to carry out the research in the selected schools. This was after the researcher was registered by the Graduate school of Kenyatta University. The copies of authorized letter from the National Council for Science and Technology were distributed to relevant offices in the Provincial Director of Education, Provincial Commissioner and in both selected integrated public primary schools in Nairobi County.

In addition, the researcher sought consent from the headteachers of the sampled schools and agreed on the appropriate dates of visiting the schools for the data collection. The respondents were assured of anonymity through a cover letter accompanying the questionnaires that described the intent of the study. The respondents were asked to return the questionnaires to their headteachers. At the beginning of the data collection, the researcher assured the respondents of confidentiality. A cover letter explains the purpose of the questionnaire and also motivates the respondents of the sample to respond (Frankel & Wallen 2010).

3.11 Summary of research methodology

The chapter outlined the research methodology employed by the study. The advantages of the descriptive survey design method employed by the study were discussed. In addition, the research instruments and the data analysis tools were discussed. Chapter (4) presents the analysis, interpretation and discussion of the data obtained from the study.
CHAPTER FOUR
DATA ANALYSIS, INTERPRETATION AND DISCUSSION

4.0 Introduction

This chapter contains analysis, interpretation and discussion of the research findings. The purpose of the study was to find out factors influencing Mathematics performance among learners with low vision (LV) in integrated public primary schools in Nairobi County. The study findings were based on six research objectives restated below.

1. To determine attitudes of learners with LV towards learning Mathematics in integrated public primary schools.
2. To establish which low vision devices (LVDs) were used by the learners with LV to study Mathematics in integrated public primary schools.
3. To find out the environmental adaptations/ modifications necessary for learners with LV when studying Mathematics in integrated public primary schools.
4. To identify instructional methods and materials used by teachers of Mathematics to teach learners with LV in integrated public primary schools.
5. To determine teachers’ attitude towards teaching Mathematics to learners with LV in integrated public primary schools.
6. To give suggestions that can be used to minimize Mathematics academic difficulties among learners with LV.

The first section describes demographic characteristics of the respondents (20 learners with LV without other disabilities in classes 4-8, their 15 teachers of Mathematics and 2 head teachers) in the two selected integrated public primary schools in Nairobi County. Then discussions of each of the research objective are presented. Data in the study are
summarized and presented in terms of frequencies and percentages, mean and standard deviation. Learners’ attitude towards Mathematics and learners’ attitude across parents’ level of education was analyzed using chi-square. All the respondents (2 headteachers, 15 teachers and 20 learners) participated in the study hence giving a questionnaire return rate of 100%.

4.1 Section one: - Demographic data.
Sample description was analyzed and presented using tables, pie-charts and bar charts. There are three sub-sections under this section: The first sub-section presents the demographic information for the learners with LV, second sub-section deals with teachers’ of Mathematics information while the third sub-section presents head teachers’ information.

4.1.1 Demographic characteristics of learners
The study comprised 20 learners with LV without additional disabilities from two selected integrated public primary schools in Nairobi County. Of the 20 learners without additional disabilities who participated in the study, 13 (65.0%) were males while 7 (35.0%) were females.

Table 4.1 analyses the age distribution of learners with LV who participated in the study. Table 4.1 illustrates that 6 (30%) learners were aged between 8 – 11 years, 13 (65%) were aged between 12 – 15 years while 1 (5.0%) was above 15 years.
Table 4.1: Age of learners with low vision by years

<table>
<thead>
<tr>
<th>Age</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 - 9 years</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>10 - 11 years</td>
<td>4</td>
<td>20.0</td>
</tr>
<tr>
<td>12 - 13 years</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>14 - 15 years</td>
<td>8</td>
<td>40.0</td>
</tr>
<tr>
<td>16 - 17 years</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Mean = 12.65

The findings indicated that the mean age of learners with LV was 12.65 with the youngest at 8 years and the oldest at 17 years. The age range of 14-15 was the mode or most frequent, representing 8 learners with LV. It may be assumed that learners with LV had begun school late due to late diagnosis of the disability. It may be also assumed that several learners had repeated classes because KCPE candidates should be within a mean age of 13 years. However, Bala and Bhaskara (2004) indicated that, learners with LV are noted to be retarded by at least one to two years and are found to be under-achievers, vision impairment being the main factor for slower acquisition of information by observation. Table 4.2 shows classes in which respondents were.

Table 4.2: Classes for respondents

<table>
<thead>
<tr>
<th>Class</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Std 4</td>
<td>7</td>
<td>35.0</td>
</tr>
<tr>
<td>Std 5</td>
<td>6</td>
<td>30.0</td>
</tr>
<tr>
<td>Std 6</td>
<td>4</td>
<td>20.0</td>
</tr>
<tr>
<td>Std 8</td>
<td>3</td>
<td>15.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Table 4.2 shows that 7 (35.0%) pupils were in class 4, 6 (30.0%) were in class 5, 4 (20.0%) were in class 6 while 3 (15.0%) were in class 8. The findings indicated that class 4 had the highest number and class 8 had the lowest number of learners with LV, thus the number decreases as the level of education increases. The opinion of the researcher is that, learners with LV dropped out before completing primary school cycle without acquiring any Mathematical skills required for life interactions because of teachers forcing them to repeat classes. Besides, they may have dropped out because of lack of proper guidance on importance of education in their life, thus ending up in the streets borrowing to eke out their living. Table 4.3 shows learners responses on their parents’ level of education.

Table 4.3: Level of education

<table>
<thead>
<tr>
<th></th>
<th>Father</th>
<th>Mother</th>
<th>Guardian</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
<tr>
<td>Primary level</td>
<td>2</td>
<td>11.8</td>
<td>2</td>
</tr>
<tr>
<td>Secondary level</td>
<td>12</td>
<td>70.6</td>
<td>13</td>
</tr>
<tr>
<td>University/college level</td>
<td>3</td>
<td>17.6</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100.0</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 4.3 shows that 70.6% of the pupils indicated that their fathers had secondary school level of education while 17.6% indicated they were university/college graduates. However, 68.4% of them reported their mothers had secondary education 21.1% indicated they had university/college qualifications. This implies that most of the parents’ had attained Secondary school level of education.
4.1.2 Demographic characteristics of teachers for Mathematics

The study comprised of 15 teachers of Mathematics from the two selected integrated public primary school in Nairobi County. Only those teachers who taught Mathematics in classes 4-8 in those classes with learners with LV in 2012 were involved in the study. Among the 15 Mathematics teachers, 8 (53.3%) were females while 7 (46.7%) were males. This implies that there was gender balance of teachers for Mathematics in the selected schools. Table 4.4 illustrates demographic characteristics of teachers.

Table 4.4: Teachers’ demographic characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KCSE/ O Level</td>
<td>10</td>
<td>66.7</td>
</tr>
<tr>
<td>A Level</td>
<td>5</td>
<td>33.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Professional qualifications</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PI Certificate</td>
<td>5</td>
<td>33.3</td>
</tr>
<tr>
<td>Degree</td>
<td>9</td>
<td>60.0</td>
</tr>
<tr>
<td>Masters’ Degree</td>
<td>1</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Teaching experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 5 years</td>
<td>2</td>
<td>13.3</td>
</tr>
<tr>
<td>6 – 10 years</td>
<td>6</td>
<td>40.0</td>
</tr>
<tr>
<td>11 – 15 years</td>
<td>6</td>
<td>40.0</td>
</tr>
<tr>
<td>More than 15 years</td>
<td>1</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>15</td>
<td>100.0</td>
</tr>
</tbody>
</table>

As shown in Table 4.4, majority 10 (66.7%) of the teachers teaching Mathematics to learners with LV had attained KCSE/O level Certificates whereas the remaining 5
(33.3%) teachers had studied up to A level. In relation to professional qualifications, 5 (33.3%) teachers were holders of P1 certificate, 9 (60.0%) had Degree qualifications while 1 (6.7%) was a holder of a Masters Degree. This shows that despite most of the teachers reporting they had attained O level as the highest level of education most of them (60.0%) had additional degree qualifications. Therefore, they could be conversant with various methods of teaching Mathematics to learners with LV at primary level (KIE, 2002). From the table 4.4, it can also be observed that majority (80.0%) of teachers had an experience of 6 – 15 years. Thus, this population was representative of an experienced group. Since they had undergone teacher training, they might have appropriate knowledge, skills and attitudes to teach these learners, thus the education of these learners with LV will improve. This shows that most teachers had taught Mathematics for a long time and hence they could be able to give factors which influenced these pupils’ performance in integrated public primary schools.

Figure 4.1: Illustrates other subjects taught by teachers of Mathematics
N=26. This differs from the sample size because respondents taught more than one subject as indicated in Figure 4.3. According to the findings, 30% of teachers of Mathematics also teach Science, 26.9% Social Studies, 19.2% Kiswahili, 15.4% English and 7.7% CRE. This really implies that, most of the teachers of Mathematics teaching learners with LV in the selected integrated public primary schools also teach Science and Social Studies.

4.1.3 Demographic characteristics of headteachers

The study had two headteachers purposefully sampled from the two integrated public primary schools used in the study. The two headteachers were asked to give their qualifications, professional qualifications, gender and headship experience in his/her current school, subjects taught and the classes. According to the research findings, one respondent was a female and the other one was a male. This implies that there was gender balance in administration. The level of education of the female respondent was East African Certificate Education (EACE) and the male respondent was an A-Level. On the side of training education level, they had a Degree in Education (Arts) and PI Certificate respectively. This shows that none of the headteachers had trained in Special Needs Education. Mugo (2007) recommended that headteachers that are experienced and trained on how to manage special schools to head all schools with integrated programmes. The female respondent taught social studies, CRE and English in classes six and eight while the male respondent taught Mathematics in class eight only.
4.2 Attitudes of learners with low vision without additional disabilities

The first objective of the study was to determine attitudes of learners with LV towards learning Mathematics in integrated public primary schools. Attitude refers to a learned predisposition or tendency on the part of an individual to respond positively or negatively to some object, situations, concept or another person (Aiken, 1970). To address this objective, learners with LV without additional disabilities were presented with 7 items based on their attitude towards Mathematics. They were required to state their agreement levels on a Five-point likert scale ranging from strongly agree to strongly disagree. Table 4.5 shows responses obtained.

Table 4.5: Learners preference on Mathematics subject

<table>
<thead>
<tr>
<th>Statement</th>
<th>SA</th>
<th>A</th>
<th>UN</th>
<th>D</th>
<th>SD</th>
<th>M</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils who do well in Mathematics are respected</td>
<td>9</td>
<td>45.0</td>
<td>2</td>
<td>10.0</td>
<td>7</td>
<td>35.0</td>
<td>2</td>
</tr>
<tr>
<td>Mathematics is boring</td>
<td>6</td>
<td>30.0</td>
<td>9</td>
<td>45.0</td>
<td>0</td>
<td>0.0</td>
<td>5</td>
</tr>
<tr>
<td>It is interesting to do number problems</td>
<td>1</td>
<td>5.0</td>
<td>9</td>
<td>45.0</td>
<td>3</td>
<td>15.0</td>
<td>3</td>
</tr>
<tr>
<td>Mathematics helps me learn and think better</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
<td>10.0</td>
<td>14</td>
<td>70.0</td>
<td>0</td>
</tr>
<tr>
<td>It is fun to work out Mathematics</td>
<td>1</td>
<td>5.0</td>
<td>3</td>
<td>15.0</td>
<td>0</td>
<td>0.0</td>
<td>15</td>
</tr>
<tr>
<td>Mathematics is my favourite subject in school</td>
<td>0</td>
<td>0.0</td>
<td>4</td>
<td>20.0</td>
<td>2</td>
<td>10.0</td>
<td>4</td>
</tr>
<tr>
<td>It is interesting to do word sums</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
<td>5.0</td>
<td>1</td>
<td>5.0</td>
<td>10</td>
</tr>
</tbody>
</table>

Key: Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), Strongly Disagree (SD)
Table 4.5 shows that the mean scores obtained by learners on preference of Mathematics ranged between 3.90 and 1.75. The mid-point of the scale was 3 in which scores above 3.5 denoted that learners agreed with the statement, above 2.5 but less than 3.5 denoted undecided while mean scores below 2.5 denoted learners disagreed with the statement.

The statements that the learners with LV agreed with were: Pupils who do well in Mathematics are respected and Mathematics is boring. This implies that, although learners had a positive attitude towards Mathematics, they viewed the subject as boring.

The statements that the learners with LV disagreed with were: It is interesting to do word sums, Mathematics is my favourite subject in school and it is fun to work out Mathematics. This was an indication of negative attitudes towards Mathematics. On the statements, ‘Mathematics helps me learn and think better’ and it is interesting to do number problems, the learners with LV (70%), were undecided. This is an indication that respondents may be lacking proper guidance regarding importance of Mathematics.

Based on the findings above, it emerged that learners with LV in the selected integrated public primary schools in Nairobi County had negative attitudes towards Mathematics. These results agreed with that of Njoroge (2011) who found out those non-disabled learners in class six (6) in Nairobi County had negative attitudes towards the subject.

Thus, negative attitudes of these learners may have led them to perform poorly in Mathematics. Further, Adera (2004) stated that, attitudes towards Mathematics affect performance as a subject. From these studies, it can be viewed that, regular learners and learners with LV in integrated primary schools in Nairobi County had negative attitudes towards the subject. The knowledge of Mathematics is needed at every step or stage of
life and it is possible to do without the knowledge of our mother tongue, but life becomes a hell without knowledge of calculation (Sudhir and Ratnalikar, 2003).

To verify the above findings, Chi-square test was conducted based on learners preferences on Mathematics across gender. The results of the analysis are presented in Table 4.6.

Table 4.6: Pupils’ attitude towards Mathematics across gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Attitude</th>
<th>Total</th>
<th>Chi-square statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>Neutral</td>
<td>Positive</td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

Not significant at $p<0.05$

Based on the Chi-square test, the result revealed that both male pupils and female pupils did not differ significantly, at $p<0.05$ on their attitudes towards Mathematics. In particular, 7 males and 6 females had negative attitudes towards Mathematics whereas 5 males were averaged: This implies that pupils had negative attitudes towards Mathematics. Primary Mathematics syllabus states that all learners should develop positive attitudes towards Mathematics and make use of their leisure time (KIE, 2002).

To determine whether parents’ level of education had an influence towards pupils’ attitudes in Mathematics, the researcher conducted chi-square test on pupils’ attitude towards Mathematics across fathers’ and mothers’ level of education. Table 4.7 and 4.8 shows the results obtained.
Table 4.7: Pupils’ attitude on Mathematics across fathers’ level of education

<table>
<thead>
<tr>
<th>Fathers’ level of education</th>
<th>Attitude</th>
<th>Total</th>
<th>Chi-square statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>Neutral</td>
<td>Positive</td>
</tr>
<tr>
<td>Primary level</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Secondary level</td>
<td>9</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>University level</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Total 11 5 1 17

$\chi^2=3.503$

$df=4$

Sig.=0.477

Not significant at $p<0.05$

As shown in Table 4.7, Chi-square test results indicated that pupils' attitudes towards Mathematics and fathers' level of education did not differ significantly at $p<0.05$. The results revealed that among 11 pupils with negative attitudes, 9 reported their fathers had attained secondary education with only 1 indicating university education level. This shows that parents' level of education did not influence learners' attitudes in Mathematics.

Table 4.8: Pupils’ attitude in Mathematics across mothers’ level of education

<table>
<thead>
<tr>
<th>Mothers’ level of education</th>
<th>Attitude</th>
<th>Total</th>
<th>Chi-square statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Negative</td>
<td>Neutral</td>
<td>Positive</td>
</tr>
<tr>
<td>Primary level</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Secondary level</td>
<td>9</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>University level</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Total 13 5 1 19

$\chi^2=2.383$

$df=4$

Sig.=0.666

Not significant at $p<0.05$
Table 4.8 illustrates that pupils' attitudes towards Mathematics and mothers' level of education did not differ significantly at $p<0.05$. Specifically, the result shows that 9 pupils with negative attitudes indicated that their mothers had attained secondary education as their highest qualifications while 2 reported primary education level. However, 1 pupil with positive attitude reported his/her mother had attained secondary education.

In addition to the results above, Chi-square test was conducted on pupils' attitudes in Mathematics across guardians' level of education. The result obtained revealed that only one pupil was taken care of by a guardian and hence no statistics are computed because guardian level of education and attitude are constants. The results findings from Table 4.7 and Table 4.8 above therefore imply that parents' level of education influenced pupils' attitudes towards Mathematics. Table 4.9 shows learners' responses on what they wished to be in future.

Table 4.9: Pupils' response on what they would have liked to become when they grew up

<table>
<thead>
<tr>
<th>Career</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer</td>
<td>9</td>
<td>45.0</td>
</tr>
<tr>
<td>Lawyer</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>Doctor</td>
<td>3</td>
<td>15.0</td>
</tr>
<tr>
<td>Manager</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Teacher</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 4.9 illustrates that 9 (45.0%) pupils indicated they would have liked to become engineers when they grew up, 5 (25.0%) lawyers, 3 (15.0%) doctors, 2 (10%) managers
while 1 (5.0%) teachers. This was an indication that the most preferred career by learners with LV was engineering. An engineer is a person whose job involves designing and building engines, machines, roads, bridges etc. Looking at the responses by learners with LV, one would wonder whether they know what engineering involves. Only 5% of the respondents would have liked to be teachers. This may show that learners had negative attitudes towards teachers of Mathematics hence, hated the subject. The analyses of the data actually showed that respondents had scanty information on career guidance.

Table 4.10: Reasons that make boys and girls with low vision dislike Mathematics

<table>
<thead>
<tr>
<th>Statement</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>%</td>
</tr>
<tr>
<td>Lack of motivation</td>
<td>13</td>
<td>65.0</td>
</tr>
<tr>
<td>Too much homework from teachers</td>
<td>9</td>
<td>45.0</td>
</tr>
<tr>
<td>Teachers not using appropriate teaching/learning materials</td>
<td>12</td>
<td>60.0</td>
</tr>
<tr>
<td>Negative attitude due to peer influence</td>
<td>12</td>
<td>60.0</td>
</tr>
<tr>
<td>Lack of parental support</td>
<td>4</td>
<td>20.0</td>
</tr>
<tr>
<td>Lack of optical low vision devices (magnifiers)</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td>Lack of non-optical low vision devices (e.g. adapted desks)</td>
<td>7</td>
<td>35.0</td>
</tr>
<tr>
<td>Family problems</td>
<td>10</td>
<td>50.0</td>
</tr>
<tr>
<td>Lack of large print text books for Mathematics</td>
<td>1</td>
<td>5.0</td>
</tr>
</tbody>
</table>
As shown in Table 4.10 above, Over 50.0% of the boys reported the following as reasons that make learners dislike Mathematics: Lack of motivation (65.0%), negative attitude due to peer influence (60.0%), teachers not using appropriate teaching/learning materials (60%), family problems (50%) and too much homework (45%). On the other hand, all the girls who took part in the study reported that the reasons that make learners to dislike Mathematics are: Lack of motivation (35.0%), teachers not using appropriate teaching/learning materials (30.0%) and negative attitude due to peer influence (30.0%). In addition, 25.0% girls of the total also indicated family problems (25%), too much homework from teachers (25.0%) and lack of non-optical low vision devices (e.g. adapted desks) (20.0%) also contributed to learners negative attitudes towards Mathematics. When pupils’ attitudes are negative towards a particular subject, teachers and everybody concerned with teaching of the subject should examine and carefully appraise the situation (Bottom, 1983).

It also emerged that the major reasons which influenced them were; lack of motivation, peer influence, teachers using inappropriate teaching and learning resources and family problems. The findings relates very closely to those of Muli (2005) as quoted by Waudo, (2011) who established that, factors such as lack of motivation, lack of teaching/learning resources, poor guidance and counselling of students as among the major causes of poor performance in physics in the Kenya Certificate of Secondary Schools examination in Matomo Division of Kitui District. This indicates that learners with LV and learners without disabilities had similar reasons that make them dislike science subjects. Other factors that were mentioned by learners that contribute to their negative attitude towards
Mathematics were; ignorance, less time allocated for Mathematics subject especially when doing exams, some teachers were not well conversant with Mathematics subject and teachers were not committed to their work where some do not mark pupils’ books. Njoroge (2011) also found out those teachers not marking pupils’ books and not giving immediate feedback made class six (6) pupils in regular public primary schools in Nairobi to develop negative attitudes towards Mathematics. Through feedback, teachers of Mathematics can become aware of how their classrooms function and thus bring about the changes they desire.

4.3 Low vision devices used by learners with low vision when studying Mathematics

The second study’s objective was to establish the low vision devices (LVDs) used by the learners with LV to study Mathematics in integrated public primary schools. To address this objective, the researcher first sought to establish LVDs used while teaching and learning Mathematics. Table 4.11 shows results obtained from the observational checklist.

Table 4.11 Low vision devices used by learners with low vision

<table>
<thead>
<tr>
<th>Low vision devices</th>
<th>Frequencies</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optical low vision devices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mounted spectacles magnifiers</td>
<td>7</td>
<td>35.0</td>
</tr>
<tr>
<td><strong>Non-Optical Low vision devices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large print mathematics textbooks</td>
<td>6</td>
<td>30.0</td>
</tr>
<tr>
<td>Bold graph papers</td>
<td>2</td>
<td>10.0</td>
</tr>
<tr>
<td>Adapted desks</td>
<td>4</td>
<td>20.0</td>
</tr>
<tr>
<td>Measuring ruler with bigger numerals</td>
<td>1</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>100.0</td>
</tr>
</tbody>
</table>
From Table 4.11, which is constructed by direct counting from classroom observational checklist, the researcher found out that majority of respondents (35%) used mounted spectacles magnifiers when studying Mathematics. Mounted spectacles magnifiers are near viewing optical devices which are designed for magnifying close objects and prints. According to a study carried by Jeanier and Morse (2007) in South Carolina, which concurred with the findings of Corn et al. (2002), providing learners with LV with magnification devices may be better than providing them with large print materials. Jeanier and Morse (2007) found out that the reading abilities of the magnification group improved more than that of large print type. Thus, mounted spectacles magnifiers will increase the reading speed of the learner with LV as he/she will be able to read through Mathematics questions, summarize and calculate them within a shorter period. Rukwaro and Kimani (2007) stated that, mounted spectacles magnifiers are the most acceptable aids because psychologically the learner expect ‘glasses’ to help him/her and they also leave both hands free to hold the measuring tools such as rulers, compasses to mention but a few when he/she is solving geometric problems.

Non-optical LVDs observed by the researcher included:- large print mathematics text books (30%), adapted desks (20%), bold graph papers (10%) and measuring tools with bigger numerals (5%). Kimani (2002) found out that, learners who uses non-optical LVDs usually fit in regular schools with minimal LV support services. Majority of these learners with LV using non-optical LVDs used large print Mathematics text books (30%). According to the two studies mentioned above, these learners can be assessed by an ophthalmologist and be recommended for magnifiers depending on the needs of the
individual learner as they will save time when calculating Mathematics problems. Adapted desks were used by 20% of the total number of learners with LV observed. Adapted desks are important as they help the learner with LV to bring the objects (Mathematics text books, bold graph papers) he/she is viewing closer to the eye. Galgiulo (2006) indicates that one of the characteristics of learners with LV is holding reading material extremely close to the face.

Bold graph papers were provided to 10% of the total respondents as they solved Mathematics problems involving drawing and interpreting graphs. Learners with LV find it difficult to see the regular graph papers, thus the bold graph papers helps them to improve their reading and manipulating skills as they interpret vertical axis and horizontal axis when asked to draw a graph. It was surprising that the teachers of Mathematics only provided learners with LV with bold graph papers but themselves they did not have a bold graph board in class for demonstration. According to KIE (2002), all primary school pupils including learners with LV should acquire the technique of collecting, representing and interpreting data. This information shows that this objective is not thoroughly taught to learners with LV in integrated public primary schools.

It is interesting to note that only one respondent was using a ruler with bigger reading unit which is a major measuring instrument when solving Mathematics involving measurements. Piaget’s theory (1985) suggests that teachers of Mathematics should always bear in mind that a learner with LV interaction with the physical environment could increase the rate of development because the opportunity to observe and manipulate objects helps him/her to think in more ways that are complex. Rulers with
bigger reading units will help learners with LV to see more clearly as they measure the lines which in return motivates them to do Mathematics. According to primary Mathematics syllabus by KIE (2002), another objective is to develop skills in measurement, approximation and estimation to all primary school learners including those with LV. This shows that learners with LV are under taught Mathematics which results in poor performance in Kenya Certificate of Primary Education (KCPE).

The result revealed that learners with LV without other disabilities have inadequate educational resources at individual and at school level. Learners with LV require more conducive materials for their education than their non-disabled peers (MOE, 2009; Kochung Report, 2003). These included optical devices such as magnifying glasses, readers, reading materials with varied print, computers audio and visual aids among others. Without them, the learner with LV cannot cope at all in the integrated programmes.

4.4 Environmental adaptations/modification for learners with low vision

The third objective of the study was to find out the environmental adaptations/modifications necessary for learners with LV when studying Mathematics in integrated public primary schools in Nairobi County. To respond to this objective, headteachers were requested to indicate environmental modification done in their integrated public primary schools. Table 4.12 show their responses.
Table 4.12: Environmental modification done in integrated public primary schools

<table>
<thead>
<tr>
<th>Item</th>
<th>School 1</th>
<th>School 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>Preference seating</td>
<td>Preference seating</td>
</tr>
<tr>
<td></td>
<td>Adapted desks</td>
<td>Adapted desks</td>
</tr>
<tr>
<td></td>
<td>Lighting (Transparent iron sheets)</td>
<td>Pupils per class range 50 - 55</td>
</tr>
<tr>
<td></td>
<td>Pupils per class range 48 - 55</td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td>Colour contrast (Yellow)</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Ramps</td>
<td></td>
</tr>
<tr>
<td>Visual displays</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Toilets</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

As shown in Table 4.12, the researcher observed the environmental adaptations that had been made available for learners with LV in integrated public primary schools in the following areas: classroom, compound, visual displays and toilets. The researcher noted that both integrated public primary schools had some modifications in the classrooms. She noted in both selected schools, there were adapted desks and learners with LV were given preferential seats. According to Kimani (2002), the use of preferential seating, if appropriate, allows the learners with LV to have ready access to information presented in the chalkboard. School one (1) had transparent iron sheets. Transparent iron sheets ensure enough lighting in the classroom and avoid too much light for learners who are photophobic. The classroom organization in both schools was congested. This is due to large number of pupils enrolled in these classrooms which was ranging from 48 to 55 pupils per class. This high number of pupils per class may hinder teacher of Mathematics...
to cater for individual differences especially to learners with LV who actually require special attention.

In school one (I), the compound had ramps and the corners of the buildings were marked in yellow colour. The yellow colour enables the learner with LV to see more clearly the buildings at a distance and also helps him/her to estimate the distance. Accessibility is crucial for learners with Low vision (Lucas, 2009). The toilets and visual displays were not modified in both selected schools. This finding agreed with Kochung Report (2003) that, toilets in regular schools with learners with special needs were in-conducive and they could not cope. Visual displays should be made clear, bold and have less detail. The visual displays used by teachers of Mathematics were those for regular pupils. More adaptations were required in those schools to improve the performance of Mathematics for learners with L.V. Some of those responses given by the head teachers are confirmed by University of Washington (2007), in a case study of Marika and Mathematics which found out that; enlarging prints, preferential seating, note taking for learners with LV and adding extra time are effective accommodations for many students with L.V. Further, Partners in Disability Forum (2007) found out that, Tanzanian learners with LV get twenty (20) minutes extra during Mathematics examination.

The headteacher of the school two (2) was not aware of the necessary adaptations for these learners. This was because his level of training was P1 certificate, thus he didn’t have knowledge on individual needs of learners with LV. Changes within schools depend on the active agreement of those within the power to implement them and the role of the headteacher is crucial (Booth and Potts, 1983). Thus, there is need to ensure those
heading schools with integrated programmes have knowledge of special needs education.

In the two selected integrated public primary schools, the headteachers stated that they get money for modifying the school environment from Free Primary Education Fund. The government allocates Ksh 10,000 to every public primary school yearly since 2004, for environment modifications (Kochung Report, 2003). When environmental modifications are done, learners with LV may learn without hindrances (Randiki, 2002).

4.5 Instructional methods and materials used by teachers of Mathematics to teach learners with low vision

The fourth objective of the study was to identify instructional methods and materials used by teachers of Mathematics to teach learners with LV in integrated public primary schools. To respond to this objective, teachers of Mathematics teaching learners with LV in classes 4 – 8 were given 17 items on instructional methods. They were required to rate their level of familiarity on a Five point-likert scale ranging from very familiar to very unfamiliar.
Table 4.13: Teachers responses on instructional methods

<table>
<thead>
<tr>
<th>Instructional methods</th>
<th>VF</th>
<th>F</th>
<th>N</th>
<th>U</th>
<th>VU</th>
<th>Mean</th>
<th>Std. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use computer assisted instruction</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
<td>6.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giving short assignments</td>
<td>4</td>
<td>26.7</td>
<td>4</td>
<td>26.7</td>
<td>2</td>
<td>13.3</td>
<td>4</td>
</tr>
<tr>
<td>Encouraging discovery method</td>
<td>3</td>
<td>20.0</td>
<td>4</td>
<td>26.7</td>
<td>3</td>
<td>20.0</td>
<td>3</td>
</tr>
<tr>
<td>Using supplementary aids (calculators, enlarged text, talking books and watches)</td>
<td>3</td>
<td>20.0</td>
<td>3</td>
<td>20.0</td>
<td>4</td>
<td>26.7</td>
<td>4</td>
</tr>
<tr>
<td>Peer tutoring</td>
<td>4</td>
<td>26.7</td>
<td>4</td>
<td>26.7</td>
<td>3</td>
<td>20.0</td>
<td>2</td>
</tr>
<tr>
<td>Ensuring active participation of all learners instead of passive listening</td>
<td>3</td>
<td>20.0</td>
<td>7</td>
<td>46.7</td>
<td>1</td>
<td>6.7</td>
<td>2</td>
</tr>
<tr>
<td>Allowing class discussion</td>
<td>2</td>
<td>13.0</td>
<td>7</td>
<td>46.7</td>
<td>4</td>
<td>26.7</td>
<td>0</td>
</tr>
<tr>
<td>Allow for brief breaks for purposes of relaxing before moving to the next step</td>
<td>1</td>
<td>6.7</td>
<td>8</td>
<td>53.3</td>
<td>3</td>
<td>20.0</td>
<td>3</td>
</tr>
<tr>
<td>Vary teaching style</td>
<td>4</td>
<td>26.7</td>
<td>6</td>
<td>40.0</td>
<td>2</td>
<td>13.3</td>
<td>2</td>
</tr>
<tr>
<td>Verbalizing as you write on the blackboard</td>
<td>4</td>
<td>26.7</td>
<td>5</td>
<td>33.3</td>
<td>4</td>
<td>26.7</td>
<td>1</td>
</tr>
<tr>
<td>Allow enough time for task completion</td>
<td>2</td>
<td>13.3</td>
<td>9</td>
<td>60.0</td>
<td>2</td>
<td>13.3</td>
<td>1</td>
</tr>
<tr>
<td>Frequent monitoring and getting feedback</td>
<td>4</td>
<td>26.7</td>
<td>6</td>
<td>40.0</td>
<td>3</td>
<td>20.0</td>
<td>1</td>
</tr>
<tr>
<td>Demonstrating problem solving strategies</td>
<td>6</td>
<td>40.0</td>
<td>5</td>
<td>33.3</td>
<td>2</td>
<td>13.3</td>
<td>2</td>
</tr>
<tr>
<td>Using real objects for learners to touch and manipulate</td>
<td>7</td>
<td>46.7</td>
<td>6</td>
<td>40.0</td>
<td>0</td>
<td>0.0</td>
<td>2</td>
</tr>
<tr>
<td>Breaking down activities to smaller steps</td>
<td>7</td>
<td>46.7</td>
<td>7</td>
<td>46.7</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
</tr>
<tr>
<td>Calling the child by name when you speak to him or her</td>
<td>9</td>
<td>60.0</td>
<td>3</td>
<td>20.0</td>
<td>1</td>
<td>6.7</td>
<td>2</td>
</tr>
<tr>
<td>Question and answer method</td>
<td>10</td>
<td>66.7</td>
<td>4</td>
<td>26.7</td>
<td>1</td>
<td>6.7</td>
<td>0</td>
</tr>
</tbody>
</table>

Key: VF – Very familiar, F – Familiar, N – Neutral, U – Unfamiliar, VF – Very unfamiliar

As shown in Table 4.13, mean scores obtained by teachers on instructional methods ranged from 1.40 to 3.93. The mean scores above 3.5 denoted that teachers were very unfamiliar with the instructional method, above 2 but less than 3 respondents were less
familiar while mean scores less than 2 denoted that they were very familiar with instructional methods. The information from Table 4.13 showed that, teachers were very familiar with the following methods: question and answer method, calling the child by name when you speak to him or her in a group, use of real objects for learners to touch and manipulate when in a group and demonstrating problem solving strategies.

In addition, respondents were less familiar with frequent monitoring and getting feedback to learners with L.V. This is important because through feedback, teachers may become aware of how their classroom functions and bring about changes they desire. Other responses that teachers of Mathematics were familiar with included; allowing enough time for task completion, verbalizing as they write on the blackboard and varying teaching styles when teaching Mathematics to learners with L.V.

However, the use of computer-assisted instructions was very unfamiliar to the respondents. This indicated that teachers of Mathematics for learners with visual impairments, including those that had gone through special needs education were not aware of the special instructional technology. The result findings therefore imply that, most of the teachers were familiar with the instructional methods while teaching learners with L.V. Educational programme, teaching content and the degree of vision of the eye of the learner usually dictates the choice of the methodology to use (Kimani, 2002). From the classroom observations, the researcher found out that there was no difference between the methods used by teachers teaching sighted pupils and those that were used to teach learners with L.V. The teacher in the regular classroom must modify instructional strategies to accommodate learners with L.V (Randiki, 2002).
The study went further to investigate five strategies that teachers of Mathematics found most effective in including pupils with LV in the classes which were mentioned in Table 4.13. Table 4.14 shows their responses.

**Table 4.14: Five effective teaching strategies**

<table>
<thead>
<tr>
<th>Strategies that are most effective</th>
<th>F</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of real objects</td>
<td>14</td>
<td>25.0</td>
</tr>
<tr>
<td>Calling the child by name when you speak to him or her in a group</td>
<td>12</td>
<td>21.4</td>
</tr>
<tr>
<td>Vary teaching styles</td>
<td>11</td>
<td>19.6</td>
</tr>
<tr>
<td>Breaking down activities to smaller steps</td>
<td>10</td>
<td>17.9</td>
</tr>
<tr>
<td>Question and answers</td>
<td>9</td>
<td>16.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>56</td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.14 show the five most effective strategies used by teachers of Mathematics in teaching learners with LV in the selected integrated public primary schools in Nairobi County. As shown in Table 4.14, (25%) of teachers teaching Mathematics indicated the use of real objects for learners with LV to touch and manipulate, (21.4%) cited on calling the child by name when you speak to him or her in a group. This is important because the learner with LV will be sure the teacher is talking to him/her. The teachers’ responses at (19.6%) reported that, teachers of Mathematics should vary teaching styles when teaching Mathematics to learners with LV. Breaking down activities into smaller steps was cited at (17.9%) while question and answer method at (16.1%).
The information from Table 4.13 and 4.14 agrees with a study conducted by Rukwaro and Kimani (2007) which suggested that, use of real objects for learners who are VI to touch and manipulate, developing the lesson with short learning steps and developing the lesson slowly, allowing enough time for exploration and individual perception through the use of all senses including vision, monitoring the learners progress closely and frequently as the teacher teaches and ensuring active participation of learners instead of passive listening are teaching strategies to teach VI. Also the use of oral-aural presentations when teaching such as discussion, question and answer, dramatization and guest speakers are some of the teaching strategies teachers should use to teach VI. They concluded that the strategies used for teaching learners who are VI are not different from the regular system but they must incorporate adjustment and modifications for effectiveness.

Other techniques that were considered most effective by respondents and were not mentioned in Table 4.11 included: Use of Individualized Education Programme (IEP), performing dramas, tone variation, guidance and counseling offered by guest speakers conversant with vision problems and formation of debate clubs. IEP is a written statement that describes what the teacher and other professionals will do to meet special needs of the learner. It allows each learner to pursue learning at his/her pace.

Apart from identifying instructional methods used by teachers of Mathematics in teaching learners with LV, the researcher was to find out whether the instructional materials used for teaching these learners in some other countries in the world were available in Kenya. This was good intention in identifying the instructional materials
which were used by learners with LV and to compare what was used in Kenya with what was used in other countries in the world. The data from the observation checklist was analyzed and summarized in the Table 4.15.
Table 4.15: Deputy Headteachers' report on instructional materials/resources for learners with low vision in integrated public primary schools

Key: S 1 - school 1  S 2 - school 2

<table>
<thead>
<tr>
<th>Learning resources</th>
<th>Available</th>
<th>Not available</th>
<th>Enough</th>
<th>Not enough</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S 1</td>
<td>S 2</td>
<td>S 1</td>
<td>S 2</td>
</tr>
<tr>
<td>Crammer abacus</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cuberithm slate</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braille ruler, compass, protractors, tapes</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tylor frame</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bold ruled/squared exercise books</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braille writers</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tactile graphic kit</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Braille books</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talking books</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large print text books</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page markers and reading windows</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telescope, microscope and binocular</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Felt pens and highlighters</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnifying glasses</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tactual diagrams</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tactual symbols and signs</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed circuit television</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Templates and writing guides</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low vision watches</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measurement tools (tapes, compasses etc)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Photocopies and overhead projectors</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talking calculators</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talking clocks</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18</strong></td>
<td><strong>15</strong></td>
<td><strong>5</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>
Table 4.15 reveals that most of the instructional materials/resources were available in the two sampled integrated public primary schools. School one (1) had 18 out of 23 while school two (2) had 15 out of 23 instructional materials. Among the instructional materials which were available, ten out of eighteen (10/18) in school one (1) had four (4) learners with LV (Table 3.1). On the other hand, twelve out of fifteen (12/15) instructional materials in school 2 were available which had sixteen (16) learners with LV classes 4 to 8 were not enough for better facilitation of teaching and learning Mathematics for learners with LV. In the two sampled integrated public primary schools, the following materials were available but not enough: braille writers, braille text books, large print Mathematics text books, telescopes, magnifying glasses, modified measuring tools (rulers, protractors, and compasses) and closed circuit television. These materials were not enough in the two schools as the deputy head teacher reported that, lower primary classes (1 – 3) had high number of learners with LV.

Closed circuit television is important as magnification is controlled depending on the needs of the user. Contrast and brightness of the image is also controlled. Braille writers and Braille text books are important to learners with LV in category II. Also, it was clear that some important instructional materials were not at all available in both schools. These were: tactile kit, LV watches, talking calculators, talking clocks, photocopies and overhead projectors. LV watches are made with large numerals, thick hour and minute hands which contrast well to the background (Rukwaro and Kimani, 2007). This will help the learner with LV to understand the concept of time thus plan all her/his time well in daily activities.
However, three (3) instructional materials which were: crammer abacus, Taylor frame, tactual symbol and signs were said to be adequate in both schools by the deputy head teachers. This shows that Nairobi County’s integrated primary schools have most of the instructional materials which were available in the internet used by other countries in teaching and learning Mathematics to learners with LV. Although most of the instructional materials were available, teachers of Mathematics were not seen using them in the classrooms when they were teaching these learners. These findings did not tally with studies conducted by Gitonga (1984) and Mohammed (1994), which found out that the major problem facing Sciences and Social Studies in primary schools in Igoji, Meru County, was lack of sufficient materials such as text books.

During the classrooms observations, the researcher noted that teachers of Mathematics did not provide the learners with LV with the instructional materials that were said to be available such as crammer abacus and tylor frame. The deputy headteacher reported that most of the instructional materials were not functioning and were outdated. Kochung (2003) found out that learners with special needs in education including those with LV require more material resources for their education than their non-disabled peers. Learners with LV need resources at individual as well as at classroom levels depending on the type and degree of their disability. Availability of instructional materials and interacting with them motivates a learner with LV as he/she is able to observe and manipulate them as guided by teachers of Mathematics. This may help him/her to think in more ways that are complex (Piaget, 1985). According to chapter 4 item 54 of the Constitution of Kenya (6th May 2010), persons with disabilities are entitled to access materials and devices to overcome constraints arising from the persons’ disabilities.
Thus, to ensure all the instructional materials are available and enough, the Kenya government through Free Primary Education Fund should give integrated primary schools more money which will enable them to purchase these special instructional materials for learners with LV.

The researcher further observed fourteen (14) classroom sessions in the two selected schools which enabled her to obtain accurate data on the instructional materials that were actually used by teachers of Mathematics, the way they manipulated them when teaching the learners with LV and also the way these learners coped with the materials and methods used by the teachers.

<table>
<thead>
<tr>
<th>Table 4.16: Classroom sessions on the use of instructional materials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of sessions</strong></td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

As indicated in Table 4.16, 42.86 % of the classroom sessions, teachers of Mathematics did not use any instructional materials and 57.14 % used instructional materials while teaching Mathematics to learners with LV. According to Barghoutti (1973), researchers in education as referred to the physical capacity of various senses has shown that, people learn and remember more from what they see. The use of multi-media approach is recommended in the learning process. Instructional materials are used to make: things clear, instructions real and to make it possible for learners with LV to learn and teach
themselves (Kimani, 2002). Changeiywo (2002) argued that the problem of inadequate facilities is a common and more serious in most schools in Kenya. This has led to the learning of Mathematics being theoretical due to lack of instructional materials. For teachers of Mathematics who used instructional materials, Table 4.17 summarizes how they were used.

Table 4.17: Use of instructional materials by teachers of Mathematics

<table>
<thead>
<tr>
<th>Sessions</th>
<th>Time used</th>
<th>Method of teaching</th>
<th>Manipulation</th>
<th>Storage</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Introduction</td>
<td>Demonstration</td>
<td></td>
<td>Taken away</td>
<td>37.5</td>
</tr>
<tr>
<td>2</td>
<td>Introduction</td>
<td>Demonstration</td>
<td>In groups</td>
<td>In class</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>Through out the lesson</td>
<td>Demonstration</td>
<td></td>
<td>In class</td>
<td>25</td>
</tr>
<tr>
<td>1</td>
<td>Through out the lesson</td>
<td>Demonstration</td>
<td>In groups</td>
<td>In class</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

As Table 4.17 shows the use of instructional materials by teachers of Mathematics where, 37.5% of the classroom sessions during Mathematics lessons teachers used instructional materials when introducing lessons by demonstrating, learners with LV were not allowed to manipulate the instructional materials and the teacher went with it after the lesson. 25% of teachers of Mathematics introduced the lesson with instructional materials by demonstration, learners with LV were allowed to manipulate instructional materials and they were left with them in class. A further 25% observed classroom sessions, teachers of Mathematics used the instructional materials through out the lessons, learners were not allowed to manipulate and the teacher left them in class. Finally, the researcher noted that
12.5% of the sessions which is one session out of eight where teachers of Mathematics used instructional materials throughout the lessons, learners with LV were allowed to manipulate them and at the end of the lessons, the instructional materials were left in class. Teachers of Mathematics who used instructional materials used demonstration method of teaching. Demonstrations are good for attracting attention of learners with LV and showing the correct steps of a process or reinforcing what the teacher have told the learners (Lucas, 2009). The technique engages multiple learner senses and can help ensure learning and understanding while emphasizing important points or concepts.

The classroom observational results in Tables 4.16 and 4.17 revealed that majority of teachers of Mathematics typically focused on the content of the task or assignment. Teachers were observed spending very little time interacting with learners with LV regarding individual attention, encouraging them to succeed and showing interest in pupil’ work. Although the teachers of Mathematics identified various instructional methods for teaching Mathematics to learners with LV, majority of them mostly used methods such as lecture, question and answer, demonstration and used sparingly the instructional materials. Learners learn best when they are actively interacting with physical environment and seek solutions for themselves which could increase the rate of development because the opportunity to observe and manipulate objects helps him/her to think in more ways that are complex (Piaget, 1985). Also instructional materials offer rich opportunities for learners with LV to develop communication skills while actively engaging in meaningful problem solving activities in groups or in class projects. Galgiulo (2006) reported that learners with LV are reluctant to participate in social and physical
activities and the use of instructional materials will motivate them in learning Mathematics in an integrated programme acquiring communication skills as well as problem solving skills.

4.2.5 Teachers' attitudes towards teaching Mathematics to learners with low vision

The fifth objective of the study was to identify teachers' attitudes towards teaching Mathematics to learners with LV in integrated public primary schools in Nairobi County. To address this objective, teachers were presented with a statement in which they were required to state their agreement levels on a five point-likert scale ranging from strongly disagree to strongly agree. Table 4.18 shows responses obtained.

Table 4.18: Teachers' attitudes towards learners with low vision

<table>
<thead>
<tr>
<th>I am happy teaching Mathematics to learners with low vision in integrated public primary schools</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of agreement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agree</td>
<td>12</td>
<td>80.0</td>
</tr>
<tr>
<td>Strongly agree</td>
<td>3</td>
<td>20.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 4.18 showed that 80% teachers of Mathematics who were selected agreed and 20% strongly agreed that they were happy teaching Mathematics to learners with LV in integrated primary schools. This was an indication that teachers had positive attitude towards learners with LV. The findings presented were in line with a study conducted by Ndirangu (1996) in Nairobi County on peer acceptance of the child who is VI within the integrated class; the results obtained indicated that all teachers involved in the integrated
programme have been exposed to the ideal of integration by teaching in integrated classes. Through such activity they had a chance to meet the learners who were VI and also learn more about integration, and so their attitudes might have been positively influenced.

4.7 Suggestions that can be used to minimize academic difficulties in Mathematics among learners with low vision

The sixth study objective was to give suggestions that can be used to minimize academic difficulties in Mathematics among learners with LV. Teachers and learners were asked to give their suggestions that may help to improve Mathematics performance of learners with LV in integrated public primary schools. The following were their recommendations:

4.7.1 Learners with low vision recommendations

Table 4.19: Learners with low vision recommendations

<table>
<thead>
<tr>
<th>Pupils recommendations</th>
<th>F</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners should develop positive attitude towards Mathematics</td>
<td>19</td>
<td>21.8</td>
</tr>
<tr>
<td>Teachers should improve on their teaching methodologies e.g. some teachers do not give explanations</td>
<td>17</td>
<td>19.5</td>
</tr>
<tr>
<td>Teachers should introduce group work and peer teaching methods in classrooms</td>
<td>16</td>
<td>18.4</td>
</tr>
<tr>
<td>Teachers should be committed in their work e.g. improve on marking pupils books, attend Mathematic lessons regularly</td>
<td>14</td>
<td>16.1</td>
</tr>
<tr>
<td>The school should ensure that there is enough teaching and learning materials</td>
<td>11</td>
<td>12.6</td>
</tr>
<tr>
<td>Teachers should improve on time allocated for Mathematics paper especially when pupils are doing exams</td>
<td>10</td>
<td>11.5</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>100.0</td>
</tr>
</tbody>
</table>

N = 87.
N=87. This differs from the sample size because the respondents gave more than one response. Four out of six responses were addressed to teachers of Mathematics by learners with LV. This may indicate that learners are blaming teachers on Mathematics for their poor performance in the subject. Table 4.19 shows that according to the learners measures that could be put in place to change attitude of learners with LV towards Mathematics were; Learners should develop positive attitude towards Mathematics (21.8%), teachers should improve on their teaching methodologies e.g. some teachers did not give explanations (19.6%), teachers should introduce group work and peer teaching methods in classrooms (18.4%). Learners with LV recommended introduction of peer teaching during Mathematics lessons. Pupils need to expose to peer through symposium especially those from good performing schools (Adora, 2004). By so doing, the learners with LV will share ideas/experiences which in return develop positive attitudes towards the subject, improving Mathematics performance.

From the result, it has been noted that none of the learners with LV mentioned the need to ensure learning devices were provided. Learning devices are one of the key factors to the effective participation of these learners in learning (MOE, 2009). From table 4.10, the researcher found out that 90% of learners with LV reported lack of LV devices did not make them dislike Mathematics. This may be the reason why they did not find it important to recommend it.

Table 4.19 revealed that 12.6% of the respondents reported that the school had a responsibility of ensuring there are enough teaching/learning materials for Mathematics. Learners with visual impairments including those with LV require more use of the
remaining senses to learn from environment (Njoroge, 1991). This is possible when
different kinds of instructional materials are provided to the learner with L.V. Lack of
learning resources is critical at primary schools and higher levels of education because
special equipment for learners with disabilities have become increasingly sophisticated
and expensive (Waudo, 2011). This is perhaps the reason why most teachers of
Mathematics have resorted to theoretical approaches to teach that often contribute to
negative perceptions of Mathematics by the learners with L.V. Where teachers of
Mathematics can not improvise the instructional materials, teachers resort to theoretical
approach that has often led to poor performance in national examinations.

4.7.2 Teachers of Mathematics recommendations

Table 4.20: Teachers of Mathematics recommendations

<table>
<thead>
<tr>
<th>Teachers recommendations</th>
<th>F</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners should develop positive attitude towards Mathematic subject and the teacher</td>
<td>15</td>
<td>20.8</td>
</tr>
<tr>
<td>The Ministry of Education should introduce in service training for Mathematic teachers. This would help teachers to improve their mastery skill towards teaching mathematics in integrated teaching programmes</td>
<td>12</td>
<td>16.7</td>
</tr>
<tr>
<td>The school should ensure there is adequate devices used by low vision learners in schools</td>
<td>11</td>
<td>15.3</td>
</tr>
<tr>
<td>Teachers should emphasize on the use of recognizable teaching aids</td>
<td>10</td>
<td>13.9</td>
</tr>
<tr>
<td>The Ministry of education employs more teachers in schools with the integrated teaching programmes. This would give teachers enough time to have an individual attention when teaching since the work loads would be minimized</td>
<td>9</td>
<td>12.5</td>
</tr>
<tr>
<td>Improve on individualized education programme (IEP)</td>
<td>8</td>
<td>11.1</td>
</tr>
<tr>
<td>Teachers should improve their teaching performances e.g. using varying teaching methods, task analysis</td>
<td>7</td>
<td>9.7</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>100.0</td>
</tr>
</tbody>
</table>
As shown in Table 4.20, teachers of Mathematics gave the following recommendations; Learners with LV should develop positive attitudes towards Mathematics subject and the subject teachers (20.8%) and the MOE should introduce in-service training for teachers Mathematics (16.7%). This would help teachers to improve their mastery skills towards teaching Mathematics in integrated teaching programmes. The government should ensure there is regular inspection throughout the year to check whether teachers of Mathematics are applying the skills to learners with LV. The school should ensure there are adequate devices used by learners with LV in schools (15.3%) and teachers should emphasize on the use of recognizable teaching aids while teaching Mathematics (13.9%). The provision of the low vision devices to schools in Kenya is through cost sharing programme (Kamunge Report, 1988).

Teachers of Mathematics (12.5%) recommended the MOE to employ more teachers in schools with integrated programmes. The classrooms for the two selected integrated public primary schools had enrolment of 48 – 55 pupils per class (Table 4.12). The recommended ratio of integrated programme for persons with visual impairment was 1:15 (Kochung Report, 2003). Thus the ratio of 1:55 was so large for the teacher of Mathematics to cater for individual attention to learners with LV when teaching Mathematics.

The result revealed 11.5% of the respondents reported that, time allocation for Mathematics paper especially when pupils with LV are doing examination is increased. Standardized tests for Mathematics that require separate answer sheet may be especially difficult to candidates with LV (Freibeng Report, 1988). The report further noted that the
mechanical task of keeping their faces on the answer sheet and in the booklet is difficulty and time consuming for these learners. Learners with LV from Tanzania were given twenty (20) minutes extra during Mathematics examination (Partners with Disabilities Forum, 2007). This indicated that teachers teaching integrated public primary schools in Nairobi County were aware of this challenge which has led to poor performance in Mathematics to learners with LV. Therefore, the MOE through Kenya National Examination Council should consider learners with LV and add them extra time during Mathematics examinations.

**Summary of chapter four (4)**

The chapter has presented analyses of the data obtained from questionnaires, interviews and observation checklists of the study. The results of the study revealed that: pupils with LV without other disabilities have negative attitudes towards Mathematics. Reasons that make them dislike Mathematics included; lack of motivation, negative attitudes due to peer influence, teachers not using appropriate teaching/learning materials, family problems and too much home work.

In addition, the study found out that in the two selected integrated public primary schools, some environmental modifications in the classrooms were noted. School one (1) which had four (4) learners with LV, had more environmental modifications as compared with school two (2) with sixteen (16) learners with LV. As for other findings that were evident in the study, a detailed summary of their research findings and recommendations are given in the chapter five.
5.1 Summary of the Study

The purpose of the study was to find out factors influencing Mathematics performance among learners with LV in integrated public primary schools in Nairobi County. The study comprised of 20 learners with LV in classes 4 -8 without additional disabilities and their 15 teachers of Mathematics from integrated public primary schools in Nairobi County. Given below is a summary of the key study findings.

5.1.2 Attitudes of learners with low vision towards learning Mathematics

The study established that mean scores obtained by learners with LV in classes 4 -8 without additional disabilities on preference of Mathematics ranged between 1.75 and 3.90. The mid-point of the scale was 3, where scores above 3.5 denoted that learners agreed with the statement, above 2.5 but less than 3.5 denoted undecided while mean scores below 2.5 denoted learners disagreed with the statement. As indicated on Table 4.5, the result revealed that learners agreed with the following statements: Pupils who do well in Maths are respected and Mathematics is boring. This implies that, although learners had a positive attitude towards Mathematics, they viewed the subject as boring. The statements that the learners with LV disagreed with were the following: It is interesting to do word sums, Maths is my favourite subject in school and it is fun to work
out sums in Mathematics. This was an indication of negative attitudes towards Mathematics. On the statements, 'maths help me learn and think better' and it is interesting to do number problems the learners with LV were undecided. This is an indication that respondents may be lacking proper guidance regarding importance of Mathematics. Based on the findings above, it emerged that learners with LV in the selected integrated public primary schools in Nairobi County had negative attitude towards learning Mathematics.

Chi-square test result revealed that both male pupils and female pupils did not differ significantly, at $p<0.05$ on their attitudes towards Mathematics. In particular, 7 males and 6 females had negative attitude towards Mathematics whereas 5 males were average. This implies that pupils had negative attitudes towards Mathematics. In relation to parents' level of education and pupils' attitude towards Mathematics, Chi-square test also revealed that pupils attitude towards Mathematics did not differ significantly at $p<0.05$ and parents' level of education had a profound effect towards pupils' attitude acquisition.

Over 50.0% of the boys reported the following as reasons that make learners dislike Mathematics: Lack of motivation (65.0%), negative attitude due to peer influence (60.0%), teachers not using appropriate teaching/learning materials (60.0%), family problems (50.0%) and too much homework (45.0%). On the other hand, all the girls who took part in the study reported that the reasons that make learners to dislike Mathematics are: Lack of motivation (35.0%), teachers not using appropriate teaching/learning materials (30.0%) and negative attitude due to peer influence (30.0). It also emerged that
the major reasons which influenced them were; lack of motivation, peer influence, teachers using inappropriate teaching and learning resources and family problems.

Other factors that were mentioned by learners that contribute to their negative attitude towards Mathematics were; ignorance, less time allocated for Mathematics subject especially when doing exams, some teachers were not well conversant with Mathematics subject and teachers were not committed to their work where some do not mark pupils' books.

5.1.2 The low vision devices used by learners with low vision

Regarding the second objective, the study found out that, majority of respondents (35%) used mounted spectacle magnifiers when studying Mathematics. Mounted spectacle magnifiers are near viewing optical devices which are designed for magnifying close objects and prints. They increase the reading speed of the learner with LV as he/she is able to read through Mathematics questions, summarize and calculate them within a shorter period. Non-optical LVDs used by learners with LV included:- large print mathematics text books (30%), adapted desks (20%), bold line graph papers (10%) and measuring tools with bigger numerals (5%).

5.1.3 The environmental adaptations necessary for learners with low vision

In response to the third objective, the study established that both integrated public primary schools had some modifications in the classrooms. The researcher noted that there were adapted desks and learners with LV were given preferential seating. School (one) I had transparent iron sheets. Transparent iron sheets ensure enough lighting in the
classroom and avoid too much light for learners who are photophobic. The classroom organization in both schools was congested. This is due to large number of pupils enrolled in these classrooms which ranged from 48 to 55 pupils per class. This high number of pupils per class may hinder teachers of Mathematics from catering for individual differences especially to learners with LV who actually require special attention. In school (one) 1, the compound had ramps and the corners of the buildings were marked yellow in colour. The yellow/white colour enables the learner with LV to see more clearly the buildings at a distance and also help him/her to estimate the distance. The toilets and visual displays were not modified in both schools. Visual displays should be made clear, bold and have fewer details. They should be displayed at the learners' eye level. The visual displays used by teachers of Mathematics were those for regular pupils. More adaptations were required in these schools to improve the performance of Mathematics for learners with LV. Extra time during examination sessions should be given to these learners and more so, the MOE to arrange for note takers for them during the class sessions

5.1.4 Instructional methods and materials used by teachers to teach learners with low vision

On the issue of instructional methods used, the study established that according to teachers, the most effective strategies used in teaching learners with LV were: Use of real objects for learners with LV to touch and manipulate (25%), calling the child by name when you speak to him or her in a group (21.4%), using varying teaching styles (19.6%), breaking down activities into smaller steps (17.9%) and question and answer (16.1%). Among the instructional materials which were available, most of them were not enough
for effective facilitation of teaching and learning Mathematics for learners with LV. In the two sampled integrated public primary schools, the following materials were available but not enough: braille writers, braille text books, large print Mathematics text books, telescopes, magnifying glasses, modified measuring tools (rulers, protractors, and pair of compasses) and closed circuit television.

5.1.5 Attitudes of teachers of Mathematics towards teaching learners with low vision
The study finally found out that, 80% of teachers of Mathematics agreed and 20% of them strongly agreed that, they were happy teaching Mathematics to learners with LV in integrated public primary schools. This was an indication that teachers had positive attitude towards pupils with LV.

5.2 Implications
Within the limitations of this study and on the basis of the findings which have been made from the data analysis and interpretation, several outcomes were suggested. To improve performance in Mathematics among learners with LV without other disabilities, the following goals should be taken into consideration.

1. To facilitate learners with LV to develop exploratory attitude and inquire strategies, the teachers of Mathematics should use a variety of teaching methods and the learners will be motivated to join Mathematics clubs. This will also promote discovery by learners thus improving performance in the subject.

2. The MOE should specifically train teachers at higher levels in teaching Mathematics to learners with LV. If the teacher has been trained in Special Needs
Education, he/she should go back for example to Kenyatta University and specialize on Mathematics as a subject. This will enable him/her to acquire proper skills and methodology of teaching Mathematics.

3. The government through MOE should ensure the environment for learners with LV is modified depending on the individual needs of the learners. When special adaptations and appropriate lighting are provided, the learner who has LV can function in the general education classroom.

4. Providing learners with LV with assistive technology such as a variety of talking computers, calculators, magnifying glasses, can go along way in developing interest of these learners. It can foster positive attitudes and this will lead to also improving their academic performance in Mathematics.

5. The teachers of Mathematics and parents have to do a lot to change the attitudes of learners with LV towards the subject.

6. The teacher of Mathematics should set a good example by being an excellent role model to the learners with LV. He/she should be punctual in class, give Mathematics assignments depending on the level of the learner and mark them in time.

7. Finally, to increase job opportunities for these learners, the government should be prepared to invest more in learners with LV. This can be achieved by encouraging
learners with LV to study more on science subjects. This will be possible after they develop positive attitudes towards Mathematics leading to improvement in Mathematics performance.

5.3 Conclusion

Based on the findings of the study as summarized above, it can be concluded that pupils had negative attitude towards learning Mathematics. The study established that pupils' attitude did not differ across gender and also that parents' level of education had an influence towards pupils' attitude in academic performance. Education is viewed as the shared responsibility of the home and the school. Parents' level of education had a profound effect towards pupils' acquisition of attitudes. This is because educated parents understand what a child likes, dislikes, interests and skills needed and therefore could be able to change the attitude of the children either positively or negatively. The study established that the major reasons that make learners with LV to dislike Mathematics were; lack of motivation, negative attitude due to peer influence, teachers not using appropriate teaching/learning materials and family problems. Other factors that contribute negatively towards Mathematics attitudes were; Ignorance, less time allocated for Mathematics subject especially when doing exams, some teachers were not well conversant with Mathematics subject and teachers were not committed to their work where some do not mark pupils’ books.

The study established that optical LV devices used by learners with LV were mounted spectacle magnifiers. On the other hand non-optical LV devices used were large print Mathematics textbooks, old graph papers, adapted desks and measuring rulers with
bigger numerals. Both selected schools had some modification in the classrooms like adapted desks and learners were given preferential seats and no modifications were done in the toilets. The study also concludes that the most effective instructional methods used to teach learners with LV Mathematics were: use of real objects for learners to touch and manipulate, calling the child by name when speaking to him/her in a group, use of varying teaching styles, breaking down activities into smaller steps and question and answer. Other techniques that were revealed to be most effective by respondents were: use of Individualized Education Programme (IEP), performing dramas, tone variation, guidance and counseling offered by guest speakers conversant with vision problems and formation of debate clubs. It was also revealed that teachers had positive attitude towards learners with LV and this could positively affects learners attitude towards Mathematics.

5.4 Recommendations

Based on the findings of this study, the following recommendations are made:-

**Policy makers**

The curriculum planners and developers to adapt primary Mathematics curriculum and make the Kenya education system more accommodative to learners with low vision which will cater for their diversity.

The Kenya National Examination Council considers adding extra time to learners with LV during examination sessions especially the Mathematics paper.

**Education administrators**

The fund that is set aside for modifying the environment by the government be increased
in all integrated public primary schools.

That, the Ministry of Education (MOE) to construct more classrooms in order to reduce the congestion in the integrated public primary schools and provide notetakers for learners with LV during Mathematics class sessions.

That the (MOE) continues to provide in-service training courses for teachers of Mathematics. This may help teachers to improve their mastery skills towards teaching Mathematics in integrated teaching programmes.

The subject inspectors should make follow-up of teachers of Mathematics and the teaching methods they use and should give feedback to the teachers after inspections are done.

That the Kenya government through the MOE and NGOs continues to support integrated programmes by promoting optical workshops which produce low cost spectacles. This will help to improve learners’ performance in various subjects including Mathematics.

**Teachers of Mathematics**

That teachers of Mathematics to develop Individualized Education Programmes (IEPs) for every learner with LV.

That teachers improve their teaching performances using varying teaching methods e.g. task analysis when teaching Mathematics. The teacher should also ensure that he/she has positive attitude towards his/her subject.

Teachers of Mathematics should include latest new skills to teach Mathematics.
Learner with low vision

That learner should develop positive attitudes towards Mathematics subject and their teachers of Mathematics.

5.5 Areas for further research

1) Due to limited scope of this study, the researcher was not able to carry out extensive research. However, it is hoped that the study will pose a challenge that would lead to further research in the area of Science subjects in integrated public primary schools.

2) The fact that this study was conducted in an urban setting, another study could be carried out in a rural school setting to act as a comparative study to the urban school setting.

3) There is need to extend the same kind of research on learners with LV to other educational levels since the poor performance in Mathematics seems to be rampant at the primary school level. It would be important to carry out studies in other educational levels like secondary and university to ascertain whether the problem is spiralling at these levels.

4) A similar study should be conducted on learners with LV on other cluster of subjects like languages and humanities in the curriculum to established these learners' performance levels across the school curriculum to gauge whether the performance is only poor in Mathematics or it is there across other school subjects.
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Kanezja HP Enterprises.


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Wakahiga, P. M. (2009). Adaptations of school environment in Murang’a district to suit


APPENDIX A
Questionnaire for teachers of Mathematics teaching learners with low vision in upper primary school in integrated public primary schools in Nairobi County
Dear respondent,
You have been purposively selected to participate in the study on factors influencing performance in Mathematics among learners with low vision in integrated public primary school in Nairobi County. All the information given will be strictly used for the study and will be treated with utmost confidentiality. Kindly ticks [✓] on the spaces provided the correct answers or supply the required information. For others, please, specify and elaborate. Your cooperation in answering the questions honestly will be appreciated.

Section A
1. Gender: Male [ ] Female [ ]
2. Education background
   a. The highest level of education attained
      KCSE/O Level [ ] A Level [ ] University [ ] Others: specify
   b. Training level
      PI Certificate [ ] Diploma [ ] Degree [ ] Others: specify
3. Your teaching experience in teaching Mathematics in an integrated programme
   0-5 years [ ] 6-10 years [ ] 11- 15 years [ ] others specify
4. Besides teaching Mathematics which other subject(s) do you teach?
   Specify
1. Please indicate the extent to which you agree with this statement,
   “I am happy teaching learners with low vision Mathematics in an integrated public primary school.”
   1 2 3 4 5
   Strongly disagree Disagree Neither agree Agree Strongly agree
   nor disagree
Section B
Please rate your familiarity with the following strategies used in teaching learners with low vision Mathematics on the scale of: 1 (very familiar), 2 (familiar), 3 (neither familiar nor unfamiliar), 4 (unfamiliar) and 5 (very unfamiliar).

<table>
<thead>
<tr>
<th>Instructional methods</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaking down activities on to smaller steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using real objects for learners to touch and manipulate</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Allow enough time for task completion</td>
<td></td>
<td></td>
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<tr>
<td>Verbalizing as you write on the chalkboard</td>
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<tr>
<td>Frequent monitoring and feedback</td>
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<tr>
<td>Calling the child by name when you speak to him or her in a group</td>
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<tr>
<td>Ensuring active participation of all learners instead of passive listening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using supplementary aids (calculators, enlarge text, talking books and watches)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demonstrating problem-solving strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use computer-assisted instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vary teaching style</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encouraging discovery method</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Peer tutoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question and answer method</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Allowing class discussion</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Allowing for brief break for purpose of relaxation before moving to the next step</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Giving short assignments</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Section C
a. List down five (5) strategies which you find to be most effective in including pupils with low vision in the classes you teach from the table above.

1. ____________________________ 4. ____________________________
2. ____________________________ 5. ____________________________
3. ____________________________

b. List down any other teaching strategies you find effective which are not mentioned in the list above. ____________________________________________

c. What suggestions do you have that may improve Mathematics performance of learners with low vision in integrated public primary schools? ____________________________________________
Appendix B

Questionnaire for classes 4, 5, 6, 7 and 8 learners with low vision without other additional disabilities in integrated public primary schools, Nairobi County

Instructions

This is not a test and therefore there is no right or wrong answers. Please read the questions and indicate your answer by either ticking [✓] or by writing the answers in the space provided where applicable. Do not write your name anywhere on this paper.

Section A

1. Your class: - STD 4 [ ] STD 5 [ ] STD 6 [ ] STD 7 [ ] STD 8 [ ]
2. Your age in years __________________
3. Gender: - Male [ ] Female [ ]
4. What is the highest level of education of your parent or guardian?

<table>
<thead>
<tr>
<th>Education level</th>
<th>Father</th>
<th>Mother</th>
<th>Guardian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary level</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Secondary level</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>University/college</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

5. Tick appropriate statement of preference on the table

Key: Strongly agree – SA Agree – A Undecided – UN Disagree – DS Strongly disagree – SDS

<table>
<thead>
<tr>
<th>Statements of preference</th>
<th>SA</th>
<th>A</th>
<th>UN</th>
<th>DS</th>
<th>SDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is fun to work out maths sums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is interesting to do word sums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is interesting to do number problems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maths is my favourite subject in school</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maths is boring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pupils who do well in maths are respected</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maths helps me learn and think better</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7. When you grow up, you would like to be a: - (Tick one only)

- Doctor [ ]
- Engineer [ ]
- Manager [ ]
- Accountant [ ]
- others [ ]

Section B

Below is a list of probable reasons that make boys and girls with low vision dislike Mathematics. Tick [ ] which ever is applicable.

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of motivation</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Too much homework from teachers</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Teachers not using appropriate teaching/learning materials</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Negative attitudes due to peer influence</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Lack of parental support</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Lack of optical low vision devices (magnifiers)</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Lack of non-optical low vision devices (e.g. adapted desks)</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Family problems</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Lack of large print text books for Mathematics</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

Section C

i. List down other factors not mentioned above that may make learners with low vision dislike Mathematics
   a. ____________________________
   b. ____________________________

ii. Write down what you would like to be done to make pupils with low vision like Mathematics?
   c. ____________________________
   d. ____________________________
Appendix C
Interview schedule for headteacher in integrated public primary schools, Nairobi

Section A
Individual particulars
1. Gender: Male [ ] Female [ ]
2. a. Level of education: KCSE/O Level [ ] A Level [ ] University [ ] others ______
   b. Level of training: P1 [ ] Diploma [ ] Degree [ ] others ______
3. Number of years as a head in this school _________
4. Which subjects do you teach? ____________________________
5. Which classes? ____________________________

Section B
4. What is the average enrolment of total number of pupils in upper primary classes with learners with low vision? ____________________________
5. Which environmental modifications have been done to make the school environment barrier free for learners with low vision?
   Classrooms: _________ Toilets: _________
   Compound: _________ Others: _________
6. What other environmental modifications are necessary to make the school environment barrier free to these learners?
   Classrooms: _________ Toilets: _________
   Compound: _________ Visual display: _________
7. Where does the school get money for modifying the school environment?
   ____________________________
   ____________________________
8. How do environmental modifications improve learning in Mathematics of learners with low vision?
   a. ____________________________
   b. ____________________________
Appendix D

Classroom observation checklist to be used as the Mathematics lesson progresses

Name of the school: ____________________________ Class: ____________________________
No. of pupils: Total ________ Blind ________ Low vision ________
Time: ____________________________ Objectives: ____________________________

Teacher’s section

a. List down the teaching aids used
   i. ____________________________
   ii. ____________________________

b. General comments on point at which the materials are used:
   i. Introduction ________ iii. End of the lesson ________
   ii. As lesson progresses ________ iv. No aid materials used ________

c. Comment on how the learners are allowed to interact with the instructional materials in class;
   i. Teacher demonstrates for the class [ ]
   ii. The instructional aid is passed round as the lesson progresses [ ]
   iii. The teacher visits each pupil and demonstrates to the pupils using the instructional materials [ ]
   iv. Others ____________________________

d. Are pupils with low vision at times asked to refer to the visual content in their text books? Yes [ ] No [ ]

e. Do pupils with low vision use low vision devices while interacting with instructional materials? Yes [ ] No [ ]

What types of low vision devices? ____________________________

f. If pupils are using the materials, does the teacher:
   i. Give general introduction before use? Yes [ ] No [ ]
   ii. Move from individual/group to individual/group? Yes [ ] No [ ]
   iii. Choose aids related to what is being taught? Yes [ ] No [ ]
   iv. Ensure favourable lighting in the class for the pupil with low vision? Yes [ ] No [ ]

   Others ____________________________

g. After the instructional materials have been used during the lesson, does the teacher:
   i. Leave them in the class cupboard? Yes [ ] No [ ]
   ii. Leave them with the class prefect/monitor? Yes [ ] No [ ]
   iii. Take them away? Yes [ ] No [ ]
   iv. Others ____________________________
Appendix E
Observation checklist to be filled by the researcher in the library/store in company of the deputy head teacher on availability and quantity of Mathematics instructional resources for learners in integrated public primary schools

<table>
<thead>
<tr>
<th>Learning resources</th>
<th>Available</th>
<th>Not available</th>
<th>Enough</th>
<th>Not enough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crammer abacus</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Cuberithm slate</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Braille ruler, compass, protractors, tapes</td>
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<tr>
<td>Tylor frame</td>
<td></td>
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<tr>
<td>Bold ruled/squared exercise books</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Braille writers</td>
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<tr>
<td>Tactile graphic kit</td>
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<tr>
<td>Braille books</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Talking books</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Large print text books</td>
<td></td>
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<tr>
<td>Page markers and reading windows</td>
<td></td>
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<tr>
<td>Telescope, microscope and binocular</td>
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<tr>
<td>Felt pens and highlighters</td>
<td></td>
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<tr>
<td>Magnifying glasses</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Tactual diagrams</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Tactual symbols and signs</td>
<td></td>
<td></td>
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<tr>
<td>Closed circuit television</td>
<td></td>
<td></td>
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<tr>
<td>Templates and writing guides</td>
<td></td>
<td></td>
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<tr>
<td>Low vision watches</td>
<td></td>
<td></td>
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<tr>
<td>Measurement tools (tapes, compasses etc)</td>
<td></td>
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</tr>
<tr>
<td>Photocopiers and overhead projects</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Talking, calculators</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talking clocks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "Factors influencing performance in mathematics among learners with low vision in integrated public primary schools in Nairobi County, Kenya," I am pleased to inform you that you have been authorized to undertake research in Nairobi County for a period ending 31st July, 2012.

You are advised to report to The Provincial Commissioner and the Provincial Director of Education, Nairobi 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.

DR. M. K. RUGUTT, PhD, DSC.
DEPUTY COUNCIL SECRETARY

Copy to:

The Provincial Commissioner
The Provincial Director of Education
Nairobi County.