EFFECTS OF THE JIGSAW TECHNIQUE ON THE PERFORMANCE OF STUDENTS WITH VISUAL IMPAIRMENT IN GEOGRAPHY AT THIKA HIGH SCHOOL FOR THE BLIND, KENYA

By

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JULY 2008
DECLARATION

This thesis is my original work and has not been presented for the award of a Degree in any other University.

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Effects of the jigsaw technique on
DEDICATION

This Masters thesis is dedicated to my dear parents, my late father Benjamin and Mum Martha, for their unfailing love and support and to my brother Luke for being a source of inspiration and to my family, husband Raphael for unavering support, my beloved children Isaac and Ann who gave me hope and a reason to struggle. To Martha, a renewal of God’s blessings, bringing added joy to the family.
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To Almighty God: Be all glory and honor forever!
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ABBREVIATIONS AND ACRONYMS

CG: -------------------------------------Control Group
CATs: -----------------------------------Continuous Assessment Tests
EG: ---------------------------------------Experimental Group
FVE: --------------------------------------Functional Visual Efficiency
GoK: -------------------------------Government of Kenya
IQ: -------------------------------Intelligence Quotient
KCSE: --------------------------------Kenya Certificate of Secondary education
KNEC: --------------------------------Kenya National Examination Council
KESSP: --------------------------------Kenya Education Sector Strategic Plan
KIE: --------------------------------Kenya Institute of Education
KLB: --------------------------------Kenya Literature Bureau
LV: --------------------------------Low Vision
MOE: --------------------------------Ministry of Education
MoEST: --------------------------------Ministry of Education Science and Technology
SNE: --------------------------------Special Needs Education
STAD: --------------------------------Student Team Achievement Division
TGT: --------------------------------Teams Games Tournament
UN: --------------------------------United Nations
UNESCO: ------------------------------United Nations Ministry of Educational, Scientific and Cultural Organization
VI: --------------------------------Visually Impaired
ABSTRACT

The purpose of the research was to analyze effects of the Jigsaw Technique, on performance in geography form two students with visual impairments. Specifically, the study investigated the effects of the Jigsaw Technique on performance in geography of students with visual impairments, impact of the category of visual impairment, that is, low vision and the blind, on performance in geography; effect of gender disparities on performance in geography and the difference in performance of students using Braille and those using print as a medium of writing when jigsaw technique was used. Aspects of the motivational, social, cognitive and developmental theories were integrated to guide this study. The target population comprised of 40 students in the form two classes in, Thika High School for the Blind. The research sample included 20 students for the experimental group and 20 for the control group, drawn purposively from the form 2 classes. Non-Standardized Structured (teacher made) tests were developed by the researcher to measure the students’ Pre and Post instruction achievements in geography. The scores in the pre and post-tests obtained in the two experimental groups were recorded, graded and ranked. Data was analyzed and tabulated using descriptive statistics. To test for differences in performance between those taught through the two different instructional methods, a t-test was used. To test for differences in performance between categories of gender, vision and medium of writing of those taught through the Jigsaw technique a Kruskal-Wallis Anova was used. Both tests were performed at 0.05 level of significance. The results of the study showed that students taught through jigsaw technique of Cooperative learning performed better than those taught through the traditional lecture method. In addition, the results indicated that regardless of gender and type of instructional medium, that is, braille or print, the jigsaw technique of cooperative method was still effective as there were no significant differences established. Recommendations were made with regard to policy makers, educational planners, curriculum developers, teachers in general and teachers in schools for the visually impaired learners to emphasize and adopt the use of Jigsaw Technique to motivate and improve acquisition of knowledge and skills in learners with visual impairments, refresher and in-service courses for learning friendly teachers, child friendly learning environments, curriculum and assessment methods that take into consideration the individual needs of learners. Further research was also recommended with respect to this method of instruction to be used with other students in schools for the visually impaired and integrated programs in order to increase the validity and reliability of the technique by providing regional comparison.
CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The Kenya Education Sector Strategic Plan (KESSP) is rooted in a vision of an education system that is responsive to the educational needs of Kenyans and to the manpower requirements of the economy. The vision is guided by the understanding that, good education can contribute significantly to economic growth, improved employment prospects, and income generating opportunities (MoEST, 2003).

Researchers have attempted to make what goes on in the classroom constant with reality of the world outside the classroom (Callahan & Clark, 1988). Greater recognition ought to be given to the various skills needed to function in a society as a human being, worker, citizen, consumer, and parent, to develop awareness of the uses of knowledge and to become concerned with knowing how and not just about, as recommend by theorists and practioners. (Callahan & Clark, 1988). Researchers , view the principle of learning as an active process and argue that the goals of education encompass not only the acquisition of knowledge, but also the guidance of the individual to his/her fullest potential(Johnsen, 2001). This involves the development of a multitude of skills such as critical thinking, independent inquiry and group participatory behavior (Wehrem, 1977).

Schools require to change from being centers for formal instruction (expository teaching strategies), where the teacher acts as the sole source of information and the students as just passive recipients, and become educational institutions (heuristic teaching strategies),
where the students take a central role in their own learning and the teacher just guides. This is based on the observation that, the learning process is greatly facilitated if the students are motivated to learn by encouraging inquiry and discovery approaches, an aspect that the school curriculum should promote (Gachathi, 1976).

The telling method is the lecture method, which is the most used and for that matter abused strategy found in the classrooms. Students learn through different strategies and activities such as mastering generalization through literature, observing, experimenting, writing things down to remember them and listening. While some study for themselves others study in a group. Different individuals need different learning techniques for their self-development. Barriers in learning may stem from difficulties with learning strategies and other learning methods caused by biological, psychological, environmental factors or from a combination of all. Sensory impairment such as decrease or loss of vision is a barrier to input of external information. According to Johnsen (2001), it is the professional duty of every classroom teacher and Special Needs Educator (SNE) to develop his/her own arsenal of different methods, programs, knowledge and skills to choose from in implementing curriculum for individuals and classes.

Elliot Aronson, (Aronson, 1978) and his students at the University of Texas and the University of California first developed the Jigsaw Technique of Cooperative Learning in the early 1970s. The Cooperative strategy known as the “Jigsaw” Technique is a collaborative way of learning that encourages learning of facts and cognitive development thereby helping students create their own learning. Teachers arrange
students in groups. Each group member is assigned a different piece of information. Group members then join with members of other groups assigned the same piece of information, and research and/or share ideas about this information. Eventually, students return to their original groups to try to “piece together” a clear picture of the topic at hand. The Jigsaw Technique therefore, can be effectively used to tap on students’ individual potential to improve on their performance. The subject teacher is at liberty to modify the subject requirements to learning activities appropriate to the age and individual needs of students at any level of learning.

According to Callahan and Clark (1988), verbal exposition is the most efficient way of teaching subject matter and leads to sounder and less trivial knowledge than when pupils serve as their own pedagogues. Currently, at the Thika High School for the blind, the lecture method of instruction is the most prevalent teaching strategy used. The nature of the 8-4-4 system of education requires the use of heuristic approaches since they enhance good learning habits whereby students take an active role in their own learning. The effects of the lecture method of instruction are well reflected in the performance of the Kenya Certificate of Secondary Education (KCSE), which is a national standard test that evaluates student’s achievement as related to curriculum objectives. It serves also the purpose of certification and selection for progress to higher educational levels.

Over the last 10 years (1993-2003), Thika High School for the Blind has constantly retained a school mean score of a C- in KCSE examinations. For the last 4 years, since
the year 2002, out of a total of 16 subjects registered per year, 25% had a subject mean score of a B, the remaining 75%, geography included, the mean score was a C and below, (Thika High School for the Blind KCSE Results, 2002-2005). Students with Visual impairment compete for the same opportunities as their sighted peers. The fact is that they face a big challenge and often they are stigmatized with serious consequences of their educational and personal image. The researcher observes this average performance as not being good enough in today’s competitive society. With a culture of winning as reflected in the Kenyan exam oriented curriculum, a great deal of anxiety is experienced when performance is observed or measured. People are viewed as equal competitors without taking into consideration diverse needs of individuals with special needs in education. In a society obsessed with winning, every person is as good as his/her recent performance (Aronson, 1978).

Introduction of the 8-4-4 system of education in the 1980’s, accentuated the marginalization of students with visual impairments in Kenya. This is justified by the admission requirements and cluster subjects in public tertiary colleges and universities. This has locked them from being admitted due to competition from their sighted peers (World Bank, 2003). When admissions are occasionally done, they are based on humanitarian grounds or on self sponsorship. The researcher attributes the observed average performance by the students with visual impairments to the teaching method that is in common use, which is the lecture method (Wehrem, 1977). In view of this, it was imperative as a geography teacher, however, to experiment the impact that other teaching strategies could have on the performance of students with visual impairment in
geography as a social science and integral part of orientation and mobility for learners with visual impairment and in spatial relationships as well.

1.2 Statement of the Problem
As reflected in the Kenya Certificate of Secondary Education results, (Thika High for the Blind, 2002 – 2005), due to low performance in geography of grade C and below by students with visual impairment, it was important to conduct a study of this nature that investigated the Jigsaw in order to assess its impact on students’ performance in geography. Therefore, in this study, the researcher experimented with Jigsaw Technique, to find its impact on performance of students with visual impairments as compared to other methods of instruction especially the popular lecture method. Differences in the performance, in relation to gender and mediums of instruction that is Braille and print, of students taught through the jigsaw technique were also investigated.

1.3 Purpose of the Study
The researcher aimed at analyzing the effects of the Jigsaw Technique of Cooperative Learning on the performance of students with visual impairments in geography.

1.4 Research Objectives
Specifically the study was intended to:

(i) Investigate the difference in student’s performance of visually impaired students in geography between those who were taught using the Jigsaw Technique and those who were taught using the traditional lecture method.
(ii) Establish the impact of the category of visual impairment on student's performance in geography when the Jigsaw Technique was used.

(iii) Investigate the effect of gender differences on performance in geography when Jigsaw Technique was used.

(iv) Establish the differences in the performance of students using Braille and those using print as medium of communication when Jigsaw technique is used.

1.5 **Research Hypotheses**

There is no significant difference in performance of students in geography among:

(i) Those taught using the Jigsaw Technique of Cooperative Learning and those taught through the traditional Lecture method.

(ii) Those taught using the Jigsaw Technique of Cooperative learning in the pretest and posttest measures.

(iii) Students with low vision and the blind taught using the Jigsaw Technique of Cooperative Learning.

(iv) Between male and female students taught using the Jigsaw Technique of cooperative learning.

(v) Students using Braille and those using print as a medium of instruction.
1.6 Significance of the Study

It is hoped that the results of this study would be useful:

(i) In encouraging teachers to adopt teaching methods that will facilitate effective learning of the learners with VI in geography.

(ii) In encouraging teachers to use group evaluation techniques that reduce the emphasis on competitive examinations, because it is assumed that the Jigsaw Technique will shift emphasis from the individual to group performance.

(iii) To Kenya Institute of Education (KIE) in designing a curriculum that will actively involve students with special needs, in curriculum implementation by class procedures through self and group evaluation.

1.7 Scope and Limitations of the Study

The study was limited to Thika High School for the Blind in Thika District, Central Province of Kenya. It is the only residential special school for students with visual impairments. The school was deemed ideal for this study since extra time was needed for the students to research on their assignments in their respective Jigsaw groups during their free/prep time. Only Form 2 students were used as subjects because some Form 1 student report to school late and much of Form 1 work is orientation and introduction to secondary school curriculum. It was considered appropriate to use the Form 2 students, who had settled down and it was hoped that they would provide a good basis for a foundation to build up on. The Form 3 and Form 4 students were trying to cover the syllabus and remedial tuition. To introduce a new instructional strategy at this stage could have been distractive.
The production of teaching/learning materials in large print/ Braille was a challenge to the researcher. Variables such as, motivation and IQ, were held constant since the researcher, had no control over them.

1.8 Assumptions of the Study

For the purpose of this study, it was assumed that:

(i) The admission cut off points provided a common basic IQ point of reference.

(ii) Curriculum content is appropriate for the learners with visual impairments.

(iii) School administration and the general teaching staff would accord the researcher the necessary assistance and cooperation.

(iv) Respondents would participate freely without fear, bias or prejudice.

(v) Data given will reflect what is happening at Thika High School for the Blind and,

(vi) The Hawthorne effect will not influence the research findings.

1.9 Theoretical Framework

This study borrowed significantly from the motivational, social, cognitive and developmental theories of learning. The theory of motivation by Maslow views persons not only as individuals, but also as members of a group (Maslow et al 1998). Therefore, care must be extended to support the individual pupils as members of a collective entity, which is the class as well as developing the class as a caring environment for all pupils. Cooperative incentive structures create a situation by which group members attain their own personal goals, only if the group is successful.
The fact that the group outcomes are dependent on one another’s behavior is enough to motivate students to engage in behaviors which help the group to be rewarded since the group incentive induces students to encourage goal-directed behaviors among their group mates (Slavin, 1995). Therefore, the focus is primarily on the reward or goal structure under which students operate. Gross (1996) views the aspect of organizing the caring classroom through measures that allow the pupils personal autonomy and development of self-esteem hand in hand with respect, empathy and caring for others as important.

Related to the motivational theory, is the social learning theory by Bandura (1997). Social learning theory explains human behavior in terms of continuous reciprocal interactions between cognitive, behavioral, and environmental influences. In this view, the effects of cooperative learning on achievement are strongly mediated by group cohesiveness in the sense that students will help one another learn because they care about one another and want one another to succeed. One main purpose of the task specialization used in the Jigsaw Technique is to create interdependence among group members. The idea is that, if students value their group members as a result of team building and other cohesion building activities and are interdependent on one another, they are likely to encourage and help one another to succeed.

In related to both the motivational and social theories is the cognitive perspective based on the theory of cognitive development by Piaget (1990). In this view, interactions between and among students will in itself increase student achievement for reasons,
which have to do with mental processing of information other than motivation. According to Wittrock (1986), research in cognitive psychology has long held that, if information is to be retained in memory and be related to information that is already in memory, the learner must engage in some sort of cognitive restructuring, or elaboration of the material. One of the most effective means of elaboration is explaining the material to someone else.

In connection to motivational, social and the cognitive theories is the physical development theory by Gesell (1969, in Ndurumo (1993). Vygotsky (1978), in developmental perspective holds that, cooperative activity among children promotes growth. Children of similar ages are likely to be operating within one another’s proximal zones of development. Modeling in the collaborative group behaviors are more advanced than those that children can perform as individuals. The influences of collaborative activity on learning are functions that are formed first collectively in form of relations among children which later become mental functions for the individual. Research shows that reflection is spawned from argument (Vygotsky 1978).

In view of all the above theories of learning, it is imperative to conclude that students will learn from one another because in their discussion of the content, cognitive conflicts will arise, inadequate reasoning will be exposed, disequilibration will occur, and higher quality understanding will emerge. In this case, it can be argued that, these aspects of theoretical perspective complement rather than contradict one another.
The reinforcement of the visually impaired learner’s efforts must be both intrinsic and extrinsic. The visually impaired students learn to appreciate their efforts through the use of their senses, as well as the reaction of others towards them (Wehrem, 1977). For students with special needs in education, the main concern with a group setting is attention to individual needs, which are catered for in the Jigsaw Technique group setting as the new incentive. It was hoped that, when the students are exposed to this said technique, their morale would rise and their performance would continue to improve.

1.10 Operational Definition of Terms

For the purpose of this study, the following are the definition of terms used in this study.

**Accommodation**: Changes in input and output processes in teaching and assessment such as the format of instruction, presentation, and test practice and preparation activities.

**Cooperative Learning**: A method of instruction whereby small groups of students work harmoniously together to enhance their own and each other’s learning.

**Disability**: Any restriction or prevention of an activity resulting from impairment in the manner or within the range considered normal for a human being.

**Educationally Blind Students**: Those who are unable to use their sight and rely on other senses, such as hearing and touch for the purpose of education.

**Experimental Wise Error Rate**: The probability of making at least one type 1 error in comparing all means in an experiment.

**Functional Visual Efficiency (FVE)**. This is how well one uses his/her vision rather than the particular measure of visual acuity.
Handicap: A disability that constitutes disadvantage for a given individual in that it limits or prevents the fulfillment of a role that is normal in relation to on age, sex, social and cultural factors for that individual.

Impairment: A permanent or transitory psychological or anatomical loss or abnormality of structure of function.

Intelligence Quotient: A largely effective method of ranking people according to their analytic or academic intelligence.

Jigsaw Technique: An instructional strategy, which helps students create their own learning through collaboration.

Learning: A process that leads to the permanent acquisition and retention of knowledge, understanding, skills, attitudes and development of abilities by the learner that cannot be attributed to inherited behavior patterns or physical growth.

Modification: A change in content and/or standards/or skill expectation for different groups of students.

Teaching: A process of facilitating the development of knowledge, abilities, skills and attitudes through interaction by the learners, teacher, learning/teaching materials and the environment.

Visual impairment: A generic term for any of several conditions, which limit vision.

Zone of Proximal Development: The distance between the actual development levels as determined through problem solving under adult guidance or in collaboration with more capable peers.
CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Vision is one of our most important sources for the acquisition and assimilation of knowledge, but it is often taken for granted (Hardman, et al. 1999). The way we perceive visual stimuli shapes our interaction with and reaction to the environment while providing a foundation for the development of a more complex learning structure. Before educational programming can begin for a student who has a visual impairment, the significant people in the student’s life must understand the influence that vision loss has on learning.

A variety of definitions of vision loss has been developed related to their intended use. Visual impairment is an umbrella concept and it includes blindness and all degrees of visual loss, mild, severe and total loss (Skjøten, 1997). Currently, educators believe that the most important visual consideration is Functional Visual Efficiency (FVE) that is how well children use their vision rather than the particular measure of visual acuity (Fewell, 1983). Therefore, a person is said to be visually impaired if his/her vision is impaired to the extent that it cannot be used for learning purposes unless modification and adaptations are applied in material presentation, methodology of teaching and assessment. Generally, visual impairment including blindness means impairment in the vision that even with correction, adversely affects a child’s educational performance. The term includes both low vision (partial sight) and blindness.
Therefore, education intervention is quite important since human nature can be changed. Environment can be organized to nurture intelligence and enhance personality. Hence it is imperative that the degree of visual impairment and learning be addressed at this point.

2.2 The Degree of Visual Impairment and Learning

Students with visual impairments have a unique learning style which stems from the student’s unique perception of the world. This is exhibited in the difference between abstract and concrete conceptualization. Sighted students create abstract concepts by putting many Characteristics in a group. Students who are blind get a concrete concept of the world through tactual exploration. Since abstract concepts are based on visual information, for students with low vision on the other hand, their ability to form these concepts will depend on their amount residual vision. The degree of impairment and the student’s background and training (like the degree of proficiency in Braille) affects the usefulness of various teaching/learning strategies. Accessible description is necessary for pictures, graphics, displays or field sites for a student who is blind. Wide selections of magnifying devices are useful to students with low vision to assist in reading or working with objects that need to be observed. (www.vesid.nysed.gov/lsn)

McBride (1974), argues that, an individual’s eye condition can have varying effects on his/her method and efficiency of reading such as angle of eccentric viewing, positioning of materials, amount of information viewed at a time and use of magnification aids. The reading rate may be slower due to the extra time needed to follow a line of print, the limited number of letters or words in the field of view at each fixation, the amount of
additional processing time required to interpret a blurry or distorted image or the length of time needed to find the beginning of the next line of print.

Lack of vision causes great difficulties in concept development. Lowenfeld (1974) observed that persons with visual impairments experience loss of control of their environment. This has an effect in inhibiting the necessary social information input. Mobility problems limit their acquisition of concepts in the environment due to lack of exploratory opportunities. The blind person acquires concepts with difficulties compared to the sighted persons because information is collected in fragments through the remaining senses. The level of concept development and the capacity for cognitive functioning for children with visual impairment is more related to learning opportunities, range in variety of experiences and attention given to the explanation and clarification of the environment.

2.3 The Medium of Writing/Reading and Learning of Students with Visual Impairment.

Braille writing/reading is the widely used means of reading and writing for students with visual impairment. Nolan and Kederis (1969) suggested that the level of intellectual ability needed for efficient Braille reading is greater than that of print reading. Jones, (1970), in a study comparing the tactile and kinesthetic perceptions of the blind and sighted children, reviewed that the blind are superior in tactile sensitivity to the sighted at every age level. Reading rates of Braille readers are considerably slower than reading rates of sighted readers. More time is required to tactually explore special formats and to scan specific pieces of information that can almost be instantly perceived by the print
reader. Efforts of increasing the reading rate include controlled exposure devices and experimental use of hands and fingers to pick up information (McBride, 1974. Olson, 1975).

According to Taylor (1973), listening is a more natural process than reading. It allows better comprehension and retention. Henderson (1973) further states that, for some students with severe visual handicap, listening may actually take the place of reading due to the limited graphic materials available and the additional time required in reading. Learners with visual impairments relay on the audio-channel only in which the intake rate is sender determined and slower than the intake rate of visual channel available to the sighted learners. By far the greatest amount of information used in schools is in the form of printed materials. Therefore, the individual who is able to use printed material, even if only for a short period of time, has greater access to a wider variety of information.

2.4 Policy on Special Needs Education

The convention on the rights of the child adopted by the general assembly of the United Nations (1989), the Salamanca statement on principles, policy, practice and framework for action on Special needs education (UNESCO, 1994), are a rights based approach to education that provides the basis for comparative assessments of national progress against international commitments. The obligation of any government is to provide education as a right by translating its international commitment into a legislation against which its citizens have a legal recourse (MOE, 2006).
The Sessional Paper No. 1 of 2005 on Policy Framework for Education, Training and Research, aimed at meeting the challenges of education, training and research in Kenya in the 21st Century and committed the government to provide every Kenyan with basic quality education and training. The Kenya directorate of basic education developed a policy draft on special needs education in 2006 (MOE, 2006).

The lack of a comprehensive policy on special needs education has hampered the provision of adequate and effective education services for students with special needs. Policy guidance addresses important areas in regard to public agencies’ responsibilities in educating students with visual impairments (MoEST, 2002). Acknowledging the fact that children who receive special education and related services due to visual impairment are an extremely a diverse population, policy guidance, therefore will give background information and examples of the variety of needs of these students.

There are six special residential primary schools and one special secondary school for students with visual impairments in Kenya. There is a concern that “… services for some visually impaired students are not appropriately addressing their unique educational and learning needs, particularly their need for instruction in literacy, self-help skills, orientation and mobility (Nyaga, 1996)”. It is important, therefore, at this stage to look at the trends in instructional methods in Kenya.
2.5 Trends in Instructional Methods in Kenya

Many educational commissions have been established in Kenya since independence. They have influenced Kenya’s education by advocating change in the curriculum, which has had far-reaching implications on the instructional strategies. Ominde (1964) recommended a revision of the geography syllabus and called for child-centered instructional approaches with a call to making secondary education a training of the power of judgment, logical thinking and clear expression.

Methodological discussion is not a new phenomenon. In the 18th to 20th century, the Danish Educational and Theological Scholar, Gerhard (1988), discussed the following four main teaching methods: The Prescribing method: Lecturing, Dictation and demonstration; the Achromatic Method: Uninterrupted Lecturing; The Dialogue Method: Conversation with question and answer and the Heuristic Method in which the teacher asks questions and the pupils answer, with independent activities.

The problems in teaching methodologies were traced back to primary schools, attention to which later had an effect on secondary education. Ominde (GoK 1964) argues that, “Anyone who is familiar with primary school education is aware of the occurrence of drill methods of teaching, of authoritarian tone of voice on the part of the teacher, of neglect of activity in teaching methods and pupil’s participation...” as it was observed then, if Kenya is to bring up people of capable independent and constructive thinking, the child-centered methods should be used.
Rote learning methods came under criticism since students cannot break loose from the book rote learning methods until they are exposed to inquiry/discovery methods. The problem of instructional strategies persisted as the Gachathi Report (1976), was equally critical of teaching methods at both primary and secondary education levels. Therefore teaching methodology had to change. The teacher’s role has to change into that of providing experience through the use of inquisitive methods. The teacher’s prime responsibility should be to reduce his importance, so that he/she can help the learners to arrive at their own freedom to learn. The teacher through his/her teaching methods should help the mental development of his/her students and help them think for themselves.

In Special Needs Education, a number of classical methodological aspects are used. Learning tasks are broken down into small steps and use of examples varied. Teaching strategies in special needs education are reflected in the Jigsaw Technique. Students are organized and utilized to create their own learning through flexible solutions, creating a friendly and welcoming environment with room for all.

2.6 Instructional Methods for Students with Visual Impairment in Geography

As the principle agents in delivering instruction, teachers should use techniques that will ensure success to students who have visual problems. The reason being that the educational objectives for the sighted are similar to those of their peers with visual impairments. A specific challenge involves conveying primary visual materials to those who cannot see well (Smith, et al. 2001).
Several factors are relevant to the selection of teaching strategies that teachers can employ. The selection of one method depends upon the particular situation. Among the factors that can influence the selected strategy are, the setting in which instruction will take place, the type of learning outcome expected, and the desired degree of involvement with other learners (Scholl, 1986).

Students with visual impairments learn through visual, auditory and kinesthetic senses and rely on all of their past experience to make a connection with new materials. Corn et al. (1995) suggest that particular emphasis should be placed on developing receptive and expressive language skills. Students with visual impairments must learn to listen in order to understand the auditory world more clearly. Finely tuned receptive skills contribute to the development of expressive language, which allows children to orally describe their perception of the world. Students with visual impairments should have no inordinate problems handling the verbal content of Geography regardless of the media they use (Braille, recording, large or regular print with or without magnification) for text materials.

Graphic presentations such as use of pictures, maps, globes, and diagrams common in geography are effective ways of presenting information to sighted students but are often an obstacle to communication for the students with visual impairments persons (Scholl, 1986). Franks (1983) reviewed research relating to tactile maps and graphics to determine guidelines for tactile map design and related training materials. This data guideline addresses the complexity of design, use of symbols, spacing between symbols and
patterns, the need for tactile edges, the value of stimulus redundancy and scanning. Teachers need to design and create tactile graphics for their students who have visual impairment since the information and tools are available. Students can be instructed on how to use tactile graphics, by tracking lines, students are taught to analyze shapes when looking for distinctive features (Scholl, 1986).

Commonly used verbal formats often-present major problems, particularly for those who require tactile materials. There are risks associated with teaching-telling strategies commonly used for students with visual impairments, in that one is tempted to talk too much. In a way of explaining and describing things, one may be led to believe that students have learnt. A pedagogical rule that has the force of external law is that, whenever it is at all possible, pupils will misunderstand, misinterpret, or miss altogether what teachers tell them (Scholl, 1986). In the lecture method, the teacher tries to give the learner by word of mouth knowledge he/she possesses but the learner does not. It is unfortunate that not all lecturers are skillful to arouse pupils’ interest, set them thinking and wondering and to open up new vistas, tie together loose facts and ideas, to summarize and synthesize and review. One reason for these failures is that lectures tends to make students passive, and provide little reinforcement by which to drive home understanding and therefore results into superficial learning. Ordinary lectures are often not effective for changing attitudes, or for leading pupils to the attainment of higher cognitive goals (Callahan, et al. 1988)
Lectures are effective where teachers ask questions, pose problems, seek comments, and solicit questions. When students seek out and discuss explanations, they learn more than they would from telling. Because of its long history, the lecture method is well known and accepted by pupils. Many educators believe that most academic and social learning is based on factors such as student aptitudes or abilities, instructional environment, and teaching methodology. While these three variables do not form a complete structure capable of containing all these factors contributing to learning, they certainly account for many of the variables educators would agree are important to success in school. If learning is a result of the presence and development of certain mental abilities, school failures (both academic and social) may be the result of disabilities, with disability implying an academic or social handicap (Reynolds, & Lester, 1987).

If secondary education is to be more effective for serving students with special needs, then schools need to be more responsive to these needs and teachers need a larger differentiated repertoire of teaching strategies. Teacher training education needs to focus on capacity building curriculum. The Ministry of Education as well, need to develop the capacity to conduct curriculum improvement tailored to meet the special needs of learners as recommended by Sessional paper No 5 of 1968 on special education.

2.7 Gender and Academic Performance of Students with Visual Impairments in Geography

For the last four years from 2002 to 2005, Thika High School for the Blind national examination results reveal a constant performance of a grade C, both for boys and girls (Thika High School for the Blind, 2006). With regard to the overall performance at the
Kenya Certificate of Secondary Education (KSCE), research findings show that, generally, girls are lower achievers than boys (Eshiwani, 1985). Research conducted by Maritim (1985), revealed that boys did better than girls at the ‘O’ level examinations in all subjects. An analysis of the 1989/1990 KCSE results indicate that the percentage of candidates who scored a B grade and above was 2.1 for boys and 0.6 for girls (KNEC, 1990). However, it is important to note that given a conducive learning environment, girls can perform as well as, if not better than boys (Eshiwani, 1983).

2.8.0 Cooperative Learning

Research on Cooperative Learning is one of the greatest successes in the history of Educational research. In the early 1970’s, the amount and quality of research on this topic greatly accelerated and continues unabated today (Slavin, 1995). In its fullest conception, a cooperative situation requires that there be a common goal that everyone finds acceptable and in which students are rewarded for their efforts. In a cooperative learning environment, students’ interaction is characterized by positive goal interdependence with individual accountability. In other words, efforts of cooperative learning result in participants working to gain mutual benefit so that all group members gain knowledge and achieve success from each other’s efforts. The key point here is that students need to realize that all group members share a common fate-they either all succeed together or fail together.
2.8.1 Cooperative Learning as a Teaching Strategy

According to Johnson and Johnson (1993), Cooperative Learning as a teaching strategy has five essential components to guide the classroom teacher to achieve successful cooperative groups. Thus -:

a) Positive Interdependence;

Researchers Johnson and Johnson (1993), identified four ways of structuring positive interdependence within learning group as-:

- **Positive Goal Interdependence**: the group is motivated to achieve a common goal, they are concerned with how much each learns and they understand that they must succeed or fail together.

- **Positive Reward; Celebrate Interdependence**: each member receives the same reward which can be a group/individual grade from a test-and bonus points if all members achieve the set goals.

- **Positive Resource Interdependence**: group members combine the resources, information or materials necessary for completion of the task;

- **Positive Role Interdependence**: each group member is assigned complementary roles such as reader, recorder, and checker of understanding or encourager of participation.

b) Face to face: Promotive Interaction

This is achieved through sharing resources, helping, supporting, encouraging, and applauding each other’s efforts.
c) Individual and Group Accountability

The performance of an individual student is assessed, the results are given back to the individual and group to determine who needs more assistance, support and encouragement to learn or complete an assignment.

d) Interpersonal and Small-Group Skills

Students co-ordinate their effort in order to achieve a common goal through getting to know and trust each other, communicating accurately and without ambiguity, accepting and supporting each other and resolving conflicts constructively.

e) Group Processing.

Group members discuss how well they are achieving their goals and maintaining effective working relationships. Group processes reflect on a group session to describe what members' actions were helpful and what was not. It also makes decisions about what action needs to be continued or changed. Its purpose is to clarify and improve the effectiveness of the member's contribution as they collaborate to achieve the group goals. Group processing can be done at two levels either as a group or as a whole class.

2.8.2 Why Research and Theory Suggest Cooperative Learning as a Teaching Strategy

Researchers have suggested that students achieve more when they interact in a cooperative setting rather than in an individualistic or competitive one. A cooperative learning situation has been found by two researchers (Kagan, 1992 and Slavin, 1991) to result in higher achievement, greater productivity, more energy, supportive and committed relationships, greater psychological health, social competence and high esteem.
Students who collaborate on their studies develop a great deal of commitment and caring for each other. These students like their teacher more and perceive him/her as being more supportive and caring for their academic advancement. As a result of cooperative learning, students' ability to think creatively is enhanced due to increased and quality ideas. Students' enjoy, are stimulated, original in expression and creative in problem solving. Group members' ideas are appreciated instead of being ignored or trying to outshine them.

Research data by Kagan, (1992) and Slavin (1991), has also indicated that cooperation produced higher levels of self-esteem based on students' competence. Johnson and Johnson (1983) identified low productivity in students with low self esteem due to setting low goals for themselves, lacking confidence in their ability, and assuming that they will fail no matter how hard they try. Winners attribute their success to superior ability and attribute the failure of others to lack of ability both of which contribute to self-aggrandizement and lack of respect for others.

Cooperative learning provides situations whereby students are expected to teach one another and in this way they are better able to retain concepts and link prior knowledge with new information. There is a greater effort in achievement and greater productivity by all students, long-term retention, intrinsic motivation, achievement motivation, and time on task, higher-level reasoning, and critical thinking. Cooperative learning activities provide opportunity to evaluate important collaborative outcomes such as interactive communication, active listening, taking the perspective of others, acceptance and
accommodation of individual differences and the evaluation of final product developed through group effort. (Kagan, 1992).

In addition, Cooperative Learning in general and the Jigsaw method in particular, can be a useful addition to individualized learning programs. When individualized instruction utilizes independent study, it frequently results in reducing the child’s opportunity to develop social skills in the learning environment. Complementing individualized instruction and other classroom experiences with cooperative groups could provide a beneficial balance as well as interesting set of experiences. (Slavin, 1991).

The most widely used cooperative learning methods are Jigsaw (Aronson et al. 1978), Student Team Achievement Division (STAD; Slavin, 1980), Teams-Games-Tournament (TGT; Slavin, 1980), Learning Together (Johnson and Johnson, 1994), and Group Investigation (Sharan and Hertz – Lazarowitz, 1980), and Co-op (Kagan, 1985). In view of this, it is imperative therefore to look at the Jigsaw Technique of Cooperative Learning.

2.8.3. The History of the Jigsaw Technique of Cooperative Learning

The Jigsaw Technique was first used in 1971 in Austin, Texas. Austin had racial segregations of white, African-American, and Hispanic races. The youngsters of these three races found themselves in the same classroom for the first time following a desegregation of the town. There were long outstanding suspicions, fears, and distrusts between these groups, which produced an atmosphere of turmoil, and hostility. Aronson
was living in Austin, teaching at the University of Texas at the time. As a psychologist, Aronson had done a great deal of research in interpersonal relations; the school superintendent therefore called him upon to help the students get along with one another. After an observation, Aronson and his students concluded that, the inter-group hostility was being fueled by the competitive environment of the classrooms in which students worked individually and competed against each other for grades (Aronson, et al. 1978).

This called for a need to shift the emphasis from a relentlessly competitive atmosphere to a more cooperative one. It was in this context that the Jigsaw strategy was invented. The classrooms were restructured so that students worked together in small groups. The Jigsaw intervention was randomly introduced to some classrooms and not others. The progress of Jigsaw students was compared with that of students in traditional classrooms. After eight weeks, there were clear differences even though students spent only a small portion of their time in the Jigsaw groups (Aronson, et al. 1978).

When Jigsaw students were objectively tested, they were self-confident, reported liking school better than children in traditional classrooms. They were less absent from school than other students, and showed greater academic improvement; poorer students in the Jigsaw classroom scored significantly higher on objective exams compared to students in traditional classrooms. The good students continued to do well as well as the good students in traditional classes (Aronson, et al. 1978).
The Jigsaw Technique has since then been adapted by a number of researchers and practitioners in a variety of ways and hundreds of schools have used the Jigsaw classroom with great success (Aronson, et al. 1978). A number of studies have shown that the Jigsaw method leads to higher achievement in biology (Lazarowitz, et al. 1985), and increased positive attitudes and interest in the material studied (Van Voorhis, 1995). Research studies in a wide range of settings and across content areas have shown that the jigsaw cooperative learning enhances cooperation by making each student responsible for teaching some of the material to the group.

The basic premise of the Jigsaw is to divide a problem into sections, one for each group member. In the “Jigsaw” structure students are members of two different groups, the “home” groups and the “expert” groups. Initially, students are assigned to four or six member “home” groups to work on instructional material that has been broken down into sections. Each student is assigned a portion of the material. Then the “home” groups break apart, like pieces of the jigsaw puzzle, and each home team sends representatives to join with other representatives from all the other teams and form “expert” groups. While in the “expert” groups, the students divide and share resources that they want to study. The students then take responsibility to study intensively their particular material to ensure that they understand well and prepare it for peer tutoring. Later, each student returns to his respective “home” group, where he/she presents his/her assigned material to the rest of his/her group for comments and discussion and learns the other subtopics from his/her peers in the “home” group. After the completion of the assigned learning tasks over a number of class periods, each student takes an individual test.
The Jigsaw method is a basis for involvement by all, for taking responsibility for each other in the learning process, and for sharing ideas. As such, it is a very good method for collaborative learning. This is what Millis and Cottell (1998) refer to as the traditional Jigsaw Technique.

2.9. Summary of Literature Review

Educational assessment and evaluation consists of consideration and judgments about teaching and learning environments, process and results, and about their contextual relations. Traditionally, learners have been in the focus of assessment. Their learning achievements have been measured and given marks in comparison with other pupils in the class as well as in nation wide relational product assessment. This kind of assessment is for segregation purposes. Literature reviewed is a clear indication that the Jigsaw Technique of Cooperative learning is intended to shift emphasis from individual to group performance. Jigsaw Technique of Cooperative Learning is a collaborative way of learning that encourages learning of facts and cognitive development, support creative thinking, critical thought, art of arguing, as well as listening, appreciation of working together and encourages solidarity and care connected to joint problem solving! The classroom is used as a base where pupils get tasks where they have to go elsewhere to search for handbooks or other materials and this creates room for the learners to thrive, learn and develop.
CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This section covers a brief description of the research design, study area and target population, sampling techniques and sample size. The instrument used in the study, how they were used, their validity and reliability are discussed. Data collection and analysis procedures and finally a description of variables are provided.

3.2 Research Design

This was an experimental research design to determine the effects of Jigsaw Technique of Cooperative learning on performance in Geography of Form 2 students with visual impairments. According to Mugenda and Mugenda (1999), an experimental research design is a Pre test – Post - test control group design. Two groups of subjects were used; one was the control group, where no treatment was given. The other was the experimental group, which was given treatment. The experimental group was taught using the Jigsaw Technique of Cooperative Learning, while the control group was taught using the traditional lecture method. The experiences of the two groups were kept as similar as possible during the study.

3.3 Variables of the Study

The independent variable is a variable which the researcher manipulates in order to determine its effect or influence on another variable. The independent variable predicts the amount of variation that occurs in another variable (Gay, 1992). In this case, the
instructional strategy, that is the jigsaw technique, was the independent variable. The dependent variable also referred to as criterion variable varies as a function of the independent variable (Gay, 1992). In this case, the performance of form two students in Geography, the performance of male and female students, the performance of students with low vision and those who are blind, and the performance of the students using print and braille as their medium of reading and writing, were the dependent variables which varied as the function of the instructional strategy, that is, the Jigsaw Technique of Cooperative Learning.

3.4 Location of the Study

This study was carried out in Thika High School for the Blind, in Thika Municipality, Thika District, Central Province, Kenya. Thika town lies at 45kms North-East of Nairobi (Kenya’s capital city), between latitude 3° 53’ and 1° 45’ south of the Equator, and between longitudes 36°,35’, and 37°,25’ East of the Prime Meridian. Thika High School for the Blind is a national special school among two other general/regular education national schools found in Thika district. Administratively, the school is located in the municipal location to the North of Chania Boys and East of Chania Girls’, South of Salvation Army Primary School for the Blind, and West of the Thika town centre, actually 1km west of the town centre.

The school was deemed ideal for the study because it is the only national school of its kind purely for learners with VI. It is a residential program for both boys and girls. Other programmes are integrated for learners with VI; therefore it provided a good sample for
the study being the oldest and the only one of its kind in the country and South of the Sahara.

3.5 Target Population

The school then had a total population of 212 students, drawn from all the Primary schools for learners with VI and the integrated programs in the country. The students’ selection is based on performance by merit. The school had 73 female and 139 males. There are three streams of each class from form 1 to form 4 as presented in table 3.1.

<table>
<thead>
<tr>
<th>CLASS</th>
<th>STREAMS</th>
<th>MALE</th>
<th>FEMALE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORM 1</td>
<td>3</td>
<td>28</td>
<td>20</td>
<td>48</td>
</tr>
<tr>
<td>FORM 2</td>
<td>3</td>
<td>44</td>
<td>13</td>
<td>57</td>
</tr>
<tr>
<td>FORM 3</td>
<td>3</td>
<td>38</td>
<td>16</td>
<td>54</td>
</tr>
<tr>
<td>FORM 4</td>
<td>3</td>
<td>29</td>
<td>24</td>
<td>53</td>
</tr>
<tr>
<td>TOTAL</td>
<td>12</td>
<td>139</td>
<td>73</td>
<td>212</td>
</tr>
</tbody>
</table>

The target population for this study was 57 students in form 2 class out of which 43 were male and 14 females. In form 2 North (2N) there were 17 students, in form 2 South (2S) 20 students and in form 2 West (2W) 20 students as presented in table 3.2.
Table 3.2. Form Two Class Population

<table>
<thead>
<tr>
<th>CLASS</th>
<th>MALE</th>
<th>FEMALE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 NORTH</td>
<td>13</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>2 SOUTH</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>2 WEST</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>GRAND TOTALS</td>
<td>43</td>
<td>14</td>
<td>57</td>
</tr>
</tbody>
</table>

n = 57

3.6 Sampling Techniques

The Form 2 class of three streams, 2N with 17 students, 2W with 20 students, and 2S with 20 students, diverse in gender and ability, form a total of 57 students. Only Form 2W and Form 2S were used in the experiment, to keep the experiences of the two groups as similar as possible during the study. Form 2N was not used since it had fewer students (17). The Form 2 class was purposively sampled because;

(i) They had settled down from year 1 academic work of introduction to subjects and general orientation.

(ii) They would provide a good foundation to build up on for future continuity.

(iii) All the Form 2 students take geography as a compulsory subject, therefore forming a good representation for both control and experimental groups.

(iv) The time allocated for the geography subject is 3 lessons in a week, each lesson 40 minutes. This was appropriate to carry out the group discussions in one lesson, the presentations in the second lesson and continuous assessments in the third lesson.
The Form 3 and Form 4 geography students cannot provide an experimental and a control group since they are made up of one geography class due to clustering of subjects.

Simple random sampling technique was used to select an experimental and a control group. To pick the experimental and control groups, the researcher;

(i) Wrote 2W and 2S on two pieces of paper, and then folded them up. The class student representatives were requested to pick a piece each, and then open it up.

(ii) Wrote on two other pieces of paper, EG for Experimental Group and CG for Control Group. The researcher folded those papers up, placed them on a table then requested the class student representatives in (i), to pick a piece and open it up.

(iii) The class that matched with EG; was assigned the Experimental Group, and CG the Control Group.

(iv) Therefore, there were 20 students for the experimental group, 20 students for the control group as represented by Table 3.3, sample grid.

Table 3.3. Sample Grid

<table>
<thead>
<tr>
<th></th>
<th>CLASS</th>
<th>MALE</th>
<th>FEMALE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 SOUTH</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2 WEST</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>GRAND TOTALS</td>
<td>30</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

n=40
Previous performance in geography was considered since the classes were formed by mixed ability groups. The two classes, that is Form 2S and Form 2W had an equal student number of 20 students per class and an equal distribution of 5 female students per class and 15 male students per class with a total of 40 students used to form the control and the experimental groups.

The experimental class of 20 students was further sampled to form 4 Jigsaw groups of 5 students each. The researcher formed 4 Jigsaw groups by purposely assigning equal numbers of each category to a group, that is, the Low Vision and blind, considering the aspects of gender, and the medium of reading and writing used by each student. This helped in making these groups as similar as possible as shown by the illustration in Table 3.4.

**Table 3.4. Distribution of Sample According to Category of Visual Impairment**

<table>
<thead>
<tr>
<th>CLASS</th>
<th>MALE</th>
<th>FEMALE</th>
<th>GRAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATEGORY</td>
<td>L.V</td>
<td>Blind</td>
<td>L.V</td>
</tr>
<tr>
<td>2W</td>
<td>10</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>2S</td>
<td>12</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>GRAND TOTAL</td>
<td>22</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

The two Form 2 classes sampled had both categories of students with low vision (LV) and those who are blind. In Form 2W, 10 male and 4 females students have low vision, giving a total of 14 out of 20, whereas, in form 2S out of a total of 20 students 16 have low vision whereby 12 are male and 4 female. In form 2W, 6 students out of 20 are blind
out of which 5 are male and 1 female. Form 2S, there were no female students who are blind, but 4 male students are blind.

Among the students with visual impairment in the form 2 class, there is a category that uses Braille and another category that uses print as mediums of reading and writing depending on their visual efficiency. In this case therefore, those who use Braille as their medium of reading and writing are not necessarily the blind learners only as shown by the illustrations in Table 3.5.

Table 3.5. Distribution of Sample According to the Medium of Reading and Writing

<table>
<thead>
<tr>
<th>Class</th>
<th>Male</th>
<th>Female</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L.V</td>
<td>L.V</td>
<td>Blind</td>
</tr>
<tr>
<td></td>
<td>Print</td>
<td>Braille</td>
<td>Braille</td>
</tr>
<tr>
<td>2W</td>
<td>6</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2S</td>
<td>9</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Grand Total</td>
<td>15</td>
<td>6</td>
<td>9</td>
</tr>
</tbody>
</table>

In Form 2W, out of the 20 students, 8 students use print as a medium of reading and writing, 12 students use Braille out of which 6 have low vision. In form 2S, out of the 20 students, 11 students use print and 9 use Braille. 4 students with low vision use Braille.

3.7 Sample Size

The sample size of 40 students' took part in the study. The 20 students formed an appropriate number that was used to form 4 Jigsaw groups of 5 students each. The other
group of 20 students formed the control group. This was quite in line with special education recommendation of few students for effective management and efficient individualized attention to each student (Scholl, 1986).

3.8.0 Research Instruments

The researcher used two research instruments to collect data. The Jigsaw technique of cooperative Learning and non-standardized teacher made tests. The form two geography syllabus was used to scheme and plan for the unit to be taught, thereby controlling the previous knowledge of students in geography. The Jigsaw technique was used as the major instrument in this study to establish its effect on performance of form 2 students with visual impairment in geography. To use the Jigsaw method, the classroom was restructured so that students worked together in small groups. Each group consisted of students with different levels of academic abilities and any other considerations as already elaborated above. The researcher used the Jigsaw structure in the following stages as summarized by Clarke (1994).

Stage 1. The Introduction of the Topic to the Whole Class.

While seated in their regular seats, the researcher purposively assigned each student numbers one through five (1,2,3,4,5), to create 4 groups which were referred to as Jigsaw "home" groups of 5 students each. The researcher in so doing made sure that each group had an equal representation of both male and female, and those who use Print or Braille as the medium of reading and writing. The day’s topic was sub divided into 5 different sub topics. All students assigned number one, were assigned the same topic, all two’s the
same topic and so on. All the 5 sub topics were covered in the each Jigsaw “home” group as shown by the illustration in Table 3.6;

Table 3.6. Jigsaw “home” groups

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub Topic 1</td>
<td>Sub Topic 1</td>
<td>Sub Topic 1</td>
<td>Sub Topic 1</td>
</tr>
<tr>
<td>Sub Topic 2</td>
<td>Sub Topic 2</td>
<td>Sub Topic 2</td>
<td>Sub Topic 2</td>
</tr>
<tr>
<td>Sub Topic 3</td>
<td>Sub Topic 3</td>
<td>Sub Topic 3</td>
<td>Sub Topic 3</td>
</tr>
<tr>
<td>Sub Topic 4</td>
<td>Sub Topic 4</td>
<td>Sub Topic 4</td>
<td>Sub Topic 4</td>
</tr>
<tr>
<td>Sub Topic 5</td>
<td>Sub Topic 5</td>
<td>Sub Topic 5</td>
<td>Sub Topic 5</td>
</tr>
</tbody>
</table>

There were 4 Jigsaw groups, Group 1-4 sub-topics 1 to 5 were assigned to individual students in each group.

Stage 2. Focused Exploration Groups. Students sharing the same sub-topic broke to form 5 focused exploration groups, which were referred to as Jigsaw “expert” groups. The researcher provided resources for reference to each group, in Braille or large print as was required. The members of each Jigsaw “expert” group worked together to learn the topic, making sure that, each member understood the information. During this time, the experts constructed a plan to teach their topic to the members of their Jigsaw “home” group. See the representation in Table 3.7,
Table 3.7. Jigsaw “expert” groups

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub Topic 1</td>
<td>Sub Topic 2</td>
<td>Sub Topic 3</td>
<td>Sub Topic 4</td>
<td>Sub Topic 5</td>
</tr>
<tr>
<td>Sub Topic 1</td>
<td>Sub Topic 2</td>
<td>Sub Topic 3</td>
<td>Sub Topic 4</td>
<td>Sub Topic 5</td>
</tr>
<tr>
<td>Sub Topic 1</td>
<td>Sub Topic 2</td>
<td>Sub Topic 3</td>
<td>Sub Topic 4</td>
<td>Sub Topic 5</td>
</tr>
<tr>
<td>Sub Topic 1</td>
<td>Sub Topic 2</td>
<td>Sub Topic 3</td>
<td>Sub Topic 4</td>
<td>Sub Topic 5</td>
</tr>
</tbody>
</table>

The groups with similar topics discussed in depth. All topic 1’s, 2’s, 3’s, 4’s and 5’s formed 5 focused exploration groups.

**Stage 3. Reporting and Reshaping.** Students returned to their Jigsaw “home” groups representing the five different topics covered and instructed their teammates based on their findings from the focus Jigsaw “expert” groups. In depth discussions were carried out. Questions were raised and clarifications were made.

**Stage 4. Integration and Evaluation.** The teams connected the various pieces generated by the individual members from the expert exploration groups, which are Jigsaw “expert” groups; addressed new problems posed by the instructor, or evaluated the group product.

### 3.8.1 Non Standardized Test (teacher made test)

In order to measure the performance of both the experimental and control groups the researcher developed non-standardized structured tests on geography. This served as both
Pre-test, before the experiment and Post-test, after 3 weeks of the experiment (See Appendix F).

The researcher, on a personal note contacted Professor Aronson through his E-mail address (elliots@cats.ucsu.edu), seeking his opinion on adapting the Jigsaw classroom as an instructional strategy for the visually impaired students in geography. Professor Aronson suggested that, the researcher adapt the Jigsaw to auditory Materials like tape recordings, assigning each student one paragraph of a biography, (see appendix A). However, the researcher opted to use text materials that are easily available, cheap to use and familiar to the students in this context.

3.8.2 Validity and Reliability

There is no established validity and reliability of the Jigsaw Technique, but research studies in a wide range of settings and across content areas record that it has been used successfully (http://www.Jigsaw.org.). A number of researchers have shown that the Jigsaw method leads to higher achievement in biology (Lazarowitz et al., 1985; Dori (1995); and increased positive attitude and interest in the material studied (Van Voorhis, 1995). When adapted in a laboratory setting, the Jigsaw method divided lab work in a constructive, efficient way and provided a mechanism for students to share information and become more involved in the lab work (Colosi & Zales, 1998).
3.9 Data Collection Procedures

Data from the students was collected through the following ways:

The researcher through actual experiment collected primary data for 3 weeks. The researcher developed schemes of work for experimental Group (Appendix B) and for control group (Appendix C). Lesson plans were also developed for Experimental group, (Appendix D) and for control group (Appendix E). Lesson notes were also prepared for both the experimental and control groups. The experimental group was taught using the Jigsaw technique while the control group was taught using the traditional lecture method, integrated with question answer method. The content covered by the two groups and the learning resources were similar. The hours of exposure were the same.

The 20 students randomly selected for the experimental group formed the Jigsaw classroom. The researcher adapted and modified the following steps from Aronson (2002) to suit the study;

1) In a lesson of 40 minutes, the students in the experimental group were purposely grouped into 4 Jigsaw groups of 5 students each, diverse in gender, category of vision, medium of reading and writing and ability.

2) Through the help of the regular classroom teacher, the researcher appointed a student from each Jigsaw group as the leader. Initially, this person was the most mature student in the group.

3) The researcher divided the day’s lesson into 5 sub topics. For instance, the Geography unit on rocks was divided into;

   i) Definition of the term minerals
ii) Characteristics of minerals

iii) Definition of the term rocks

iv) Classification of rocks

v) Igneous Rocks

4) The learners were assigned their sub topics in their original Jigsaw “home” groups. The researcher made sure that learners had direct access to materials only for their own sub topic.

5) The researcher gave the learners time to read over their segments and become familiar with it. There was no need for memorizing.

6) Students from each Jigsaw “home” group, assigned the same sub topic joined together to form temporary Jigsaw “expert” groups. The students in these temporary “expert” groups were given time to discuss their sub topics. Each student noted down main points, rehearsed the presentations they made to their Jigsaw “home” groups.

7) Students then moved back to their Jigsaw “home” groups.

8) The researcher required that every representative of the “expert group” present their topics to the other members of the Jigsaw “home” group. Questions for clarification were raised and reacted upon.

9) The researcher moved around the room from one Jigsaw group to another listening, and observing the process. Incase of any trouble of a dominating member, the researcher made an appropriate intervention through a whisper to the group leader on how to intervene in such situations.

10) The researcher gave group exercises every week for the first two weeks, based on the material presented and discussed in the Jigsaw “home” groups so that students would
realize that these sessions were important and also to assess whether the students were gaining from the lessons.

Non standardized teacher-made tests on geography covering areas taught were developed by the researcher and administered to the two groups, one before introducing the new teaching method (Pre test) in the first lesson of the first week and the other after 3 weeks of teaching using the Jigsaw Technique as a new instructional method (Post- test) in the last lesson. Basically, the control and the experimental groups sat for similar tests in content and based on topic(s) covered (See Appendix F and G: Geography test and its marking scheme respectively). Performance was noted and recorded (See Appendix H)

3.10 Data Analysis Procedures

The scores for the Pre and Post - tests, were recorded. A quantitative method of data analysis was used. Data was tabulated using descriptive statistics, which included means and standard deviation. Statistical hypothesis was measured as follows:

(i) To test for differences in performance between those taught through the two instructional methods that is, Jigsaw Technique and the traditional lecture method, independent samples t-Test was used at 0.05 level of significance. Independent samples are samples that are randomly formed. That is, samples formed without matching. In such samples, the members of one group are not related to members of the other group in any systematic way other than that they are selected from the same population. It is assumed that the two groups are the same on the measure of interest at
the beginning of the study. If they are different at the end of the study, then the treatment administered to the groups will have made them different. To determine whether there is a significant difference between the means of the two independent samples, a t-Test is usually used (Babbie, 2001).

(ii) To test for differences in performance between those taught through the Jigsaw Technique of Cooperative learning in the pretest and posttest measures, a non-independent samples t-Test was used at 0.05 level of significance. Non-independent samples refer to samples or groups that are formed by some types of matching. For example, if the same group is pre-tested on some dependent variable and then post-tested at a later date, the samples are non-independent and scores on the dependent variable are expected to be correlated. A t-Test for non-independent samples is used to determine whether there are significant differences between the means of the two samples or between the means for one sample at two different times (Babbie, 2001).

(iii) To test for the differences between students with low vision and the blind, and between male and female students, and between students using Braille and those using print as a medium of instruction, all taught through the Jigsaw Technique of cooperative learning, the Kruskal-Wallis Non-parametric Anova at 0.05 level of significant was used.
4.1 Introduction

The results and analysis of the data collected for the study are presented in this chapter. The chapter is divided into three sections. The first section gives the sample description. This is followed by the statistical analyses of the hypotheses. Each hypothesis is tested and discussed separately. The hypothesis then is either accepted or rejected at 0.05 level of significance. Finally, the summary of the results is given.

4.2 Sample Distribution

In this section, frequency distributions and percentages, measures of central tendency that is, mean, mode and medium, measures of dispersion that is, standard deviation and variance were used to describe and summarize the data with reference to a number of demographic characteristics of the students in the sample studied such as gender, level of visual impairment that is low vision and total blindness, medium of instruction that is braille and print, and characteristics of the test scores in the geography test given during the pretest and posttest sessions. This information is summarized in the following tables and figure(s).

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>31</td>
<td>77</td>
</tr>
<tr>
<td>Females</td>
<td>9</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100</td>
</tr>
</tbody>
</table>
As indicated in Table 4.1, the male students were the highest in number with 77% while the female students were few in the total sample of the study with 23%. This generally reflects the usual gender inequality in enrolment trends in schools where there are more boys than girls.

The low vision students were the majority in the sample with a frequency of 31, representing 77 percent, while those with total blindness had a frequency of nine representing 23 percent of the total sample, as shown in Figure 4.1. The study sample consisted of two mediums of writing/reading, the print and the Braille. These two mediums were equally represented in the study with 50 percent (frequency of 20) each.
The characteristics of the test scores in the geography test given during the pretest and posttest measures indicated on Table 4.2 were calculated in terms of measures of central tendency that is mode, median and mean and measures of dispersion that is standard deviation and variance. This information is summarized in Table 4.2, and Figures 4.2 and 4.3.

Table 4.2 Characteristics of the Scores Distribution in the Geography Test (N = 40)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Range</th>
<th>Minimum Score</th>
<th>Maximum Score</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
<th>Median</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>40</td>
<td>25.00</td>
<td>2.00</td>
<td>27.00</td>
<td>11.15</td>
<td>6.07</td>
<td>36.90</td>
<td>11.00</td>
<td>8.00(a)</td>
</tr>
<tr>
<td>Posttest</td>
<td>40</td>
<td>48.00</td>
<td>10.00</td>
<td>58.00</td>
<td>31.42</td>
<td>13.07</td>
<td>170.91</td>
<td>30.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NB. Multiple modes exist. The smallest value is shown

As shown in Table 4.2, there was a remarkable statistical difference in the geography test scores when the pretest measures are compared with the post test measures. For instance, the pretest mean was 11.15 while the posttest mean was 31.42, giving a difference of 20.27. The indication is that, the treatment administered that is the jigsaw technique of cooperative learning had a positive effect on the performance in geography test given to the sample of students in the experimental group.

Further evidence of the positive effect, the jigsaw technique of cooperative learning had on the performance of Geography test in the students in the study is provided by the summary of the distribution of the scores in the histograms shown below in figures 4.2 and 4.3 for pretest and posttest measures.
In Figure 4.2, the pretest distribution gave a positive skewness indicating that the majority of students in the sample studied scored low in the geography test. However, in the posttest measures, figure 4.3 their scores gave a normal distribution, showing that the majority of the students scored averagely and above average with a mean of 31.4 in the geography test, giving evidence that the treatment that is the jigsaw technique of cooperative learning, had a positive effect on their performance in the geography test given.

### 4.3.0 Statistical Analysis

This section presents the results of the statistical analyses of the hypotheses of the study.

#### 4.3.1 Difference in Performance between Students Taught Through Jigsaw Technique of Cooperative Learning and Those Taught Through the Traditional Lecture Method
A t-Test for independent samples was used to test hypothesis Ho at 0.05 level of significance, in which the post measures for the experimental group were compared with those of the control group. The results of the analysis are shown in Table 4.3.

Table 4.3 T-test for Performance between Students Taught Through Jigsaw Technique of Cooperative Learning and Those Taught through the Traditional Lecture Method

<table>
<thead>
<tr>
<th>Group Statistics</th>
<th>Independent Samples Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>20</td>
</tr>
<tr>
<td>group: Post test</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
</tr>
<tr>
<td>group: Post test</td>
<td></td>
</tr>
</tbody>
</table>

P < 0.05

According to the results in Table 4.3, there was a statistically significant difference between students taught through jigsaw technique of cooperative learning and those taught through the traditional lecture method. Hence, the null hypothesis was rejected at 0.05 level of significance. This implied that experimental group of students who were taught through the jigsaw technique of cooperative learning, scored high marks in the geography test with a mean of 36.95. The control group of students, who were taught through the traditional lecture method, sat for the same geography test and got a mean of
25.90. Thus, the treatment, the jigsaw technique of cooperative learning, had a positive influence on performance in the geography test for these students.

4.3.2 Difference in Performance between Pretest and Posttest Measures in Students Taught Through Jigsaw Technique of Cooperative Learning

To further ascertain the influence of the jigsaw technique of cooperative learning the second hypothesis was performed, which tested whether there was any significant difference in geography test scores between the pretest and posttest measures in the experimental group alone.

A Paired sample t-Test was used to test hypothesis $H_{02}$ at 0.05 level of significance. The pretest and posttest measures for the experimental group alone were compared. The results of the analysis are shown in Table 4.4.

<table>
<thead>
<tr>
<th>Group Statistics</th>
<th>Paired Samples Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Pretest</td>
<td>20</td>
</tr>
<tr>
<td>Posttest</td>
<td>20</td>
</tr>
</tbody>
</table>

As shown in Table 4.4, there was a statistically significance difference in geography test scores between the pretest and posttest measures in the experimental group, that is, the
students taught through jigsaw technique of cooperative learning. The P value obtained was 0.003 less than 0.05 level of significance. The null hypothesis was therefore rejected at 0.05 level of significance. This implied that the experimental group students after being subjected to the jigsaw technique of cooperative learning scored higher marks in the geography test; they obtained a mean of 36.95 in the posttest than in the pretest before being subjected to the jigsaw technique of cooperative learning, where they scored low scores in the same test with a mean of 9.75. Hence, this affirms the results in H01, in which the treatment that is the jigsaw technique of cooperative learning, had a positive influence on performance in the Geography test.

4.3.3. Difference in Performance between the Low Vision and the Blind Students Taught Through Jigsaw Technique of Cooperative Learning

In order to test hypothesis H03, the Kruskal-Wallis Non Parametric test at 0.05 level of significance was used. The results of the analysis are shown in Table 4.5.

Table 4.5. Kruskal-Wallis Non Parametric Test for Performance between Low Vision and Blind Students Taught Through Jigsaw Technique of Cooperative Learning.

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Test Statistics(a,b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual type</td>
<td>N</td>
</tr>
<tr>
<td>Posttest measures</td>
<td></td>
</tr>
<tr>
<td>Low vision</td>
<td>15</td>
</tr>
<tr>
<td>Blind</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
</tr>
</tbody>
</table>

NB. a Kruskal Wallis Test
b Grouping Variable: Visual type

P > 0.05

52
The summary of results analysis in Table 4.5 shows that there was no statistical significance difference in Geography test scores between the low vision and blind students taught through jigsaw technique of cooperative learning. The null hypothesis was therefore accepted at 0.05 level of significance. This implied that regardless of their differences in the levels of vision, students using the jigsaw technique of cooperative learning performed more or less the same in the Geography test given. Thus, the difference in the mean ranks for each group that is 10.10 and 11.70, for low vision and the blind respectively, was insignificant since the value 0.599 obtained was greater than 0.05 level of significance.

4.3.4 Difference in Performance between the Male and the Female Students Taught Through Jigsaw Technique of Cooperative Learning

The Kruskal-Wallis Non Parametric test at 0.05 level of significance was used to test hypothesis H₀₄. The summary of the analysis is shown in Table 4.6.

Table 4.6. Kruskal-Wallis Non Parametric Test for Performance between Male and Female Students Taught Through Jigsaw Technique of Cooperative Learning

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Test Statistics(a,b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual type</td>
<td>Mean Rank</td>
</tr>
<tr>
<td>Posttest measures</td>
<td>N</td>
</tr>
<tr>
<td>Males</td>
<td>15</td>
</tr>
<tr>
<td>Females</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
</tr>
</tbody>
</table>

a Kruskal Wallis Test
b Grouping Variable: Gender

53
Table 4.6 shows that there was no statistical significance difference in Geography test scores between male and female students after being taught through jigsaw technique of cooperative learning. Thus, the null hypothesis was accepted at 0.05 level of significance. This implied that regardless of whether one was a boy or a girl his/her performance in the Geography test given was more or less the same as the rest after being taught by the jigsaw technique of cooperative learning. Thus, the difference in the mean ranks for males (11.43) and for girls (7.70) was not significant.

4.3.5. Difference in Performance Between Students using Braille and Those Using Print as Medium of Reading/Writing after Being Taught Through Jigsaw Technique of Cooperative Learning.

Hypothesis Ho5 was tested using the Kruskal-Wallis Non Parametric test at 0.05 level of significance. The results of the analysis are shown in Table 4.7

### Table 4.7. Kruskal-Wallis Non Parametric test for Performance between Students using Braille/Print as Medium Reading/Writing Taught through Jigsaw Technique of Cooperative Learning

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Test Statistics(a,b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visual type</td>
</tr>
<tr>
<td></td>
<td>Posttest measures</td>
</tr>
<tr>
<td></td>
<td>Print</td>
</tr>
<tr>
<td></td>
<td>Braille</td>
</tr>
<tr>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

P > 0.05

a Kruskal Wallis Test
b Grouping Variable: Medium of instruction
In Table 4.7, the results indicate that there was no statistically significant difference in Geography test scores between students using Braille and those using print as a medium of instruction. Hence, the null hypothesis was accepted at 0.05 level of significance. This implied that whether one used Braille or print as a medium of instruction, it did not influence his/her performance in the Geography test given after being taught by the jigsaw technique of cooperative learning. Therefore, the slight difference in the mean ranks for print based students (10.35) and for Braille students (10.65) was not significant.

4.4 Summary of Results

From data presentation and analysis, the following findings emerged:

(i) The male students were the highest in number (77 percent) while the female students were few in the total sample of the study (23 percent).

(ii) The low vision students were the majority in the sample with a frequency of 31, representing 77 percent, while those with total blindness had a frequency of nine representing 23 percent of the total sample.

(iii) The study sample consisted of two mediums of writing/reading, the print and the Braille. These two mediums were equally represented in the study with 50 percent (frequency of 20) each.

(iv) The characteristics of the test scores in the geography test given during the pretest and posttest measures showed a remarkable statistical increment giving evidence that the treatment administered, the jigsaw technique had a positive effect on the performance. For instance, the pretest mean was 11.15 while the posttest mean was 31.42, giving a difference of 20.27.
(v) There was a statistically significant difference between students taught through jigsaw technique and those taught through the traditional lecture methods. This implied that experimental group students who were taught through jigsaw technique of cooperative learning scored higher marks in the geography test than the control group students who were taught through the traditional lecture method.

(vi) There was a statistically significant difference in geography test scores between the pretest and posttest measures in the experimental group, the students taught through jigsaw technique. This implied that the experimental group students scored higher marks in the geography test in the posttest than in the pretest.

(vii) There was no statistical significance difference in geography test scores between the low vision and blind students taught through jigsaw technique. This implied that regardless of their differences in the levels of vision, students using the jigsaw technique performed more less the same in the geography test given.

(viii) There was no statistical significance difference in geography test scores between male and female students after being taught through jigsaw technique of cooperative learning. This implied that regardless of whether one was a boy or a girl his/her performance in the geography test given was more or less the same as the rest after being taught by the jigsaw technique of cooperative learning.

(ix) There was no statistically significant difference in geography test scores between students using Braille and those using print as a medium of instruction. This implied that whether one used Braille or print as a medium of instruction, it did
not influence his/her performance in the geography test given after being taught by the jigsaw technique of cooperative learning.
CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This final chapter presents an overview of the study in terms of a summary of the general approach to the problem, the implication of the findings, and a statement of conclusions. Recommendations and additional research areas are suggested as future projections based on the study.

5.2 Summary of the Study

This study was designed to investigate the effects of the Jigsaw Technique of Cooperative Learning on the performance of students with visual impairments in geography. Other variables investigated were the impact of the category of visual impairment, that is, low vision and the blind; the effect of gender disparities and the difference in performance of students using Braille and those using print as mediums of writing when jigsaw technique is used.

The target population comprised of 40 students in the form two class in Thika High School for the Blind. The research sample included 20 students for the experimental group and 20 for the control group, drawn purposively. Non-Standardized Structured (teacher made) tests was developed by the researcher to measure the students’ Pre- and Post instructional achievement in geography. The scores in the pre-and post-tests obtained in the two experimental groups were recorded, graded and ranked. Experimental research design was therefore used with the Jigsaw technique as the independent variable.

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The dependent variable was the performance of Form two students in geography, male and female, students with low vision, the blind, those who use print and Braille as their mediums of reading and writing.

Data was analyzed and tabulated using descriptive statistics, which included means, standard deviation and percentage frequencies. The hypotheses formulated in the study to test for differences in performance between those taught through the two instructional methods, were measured by t-Tests and Kruskal-Wallis Non Parametric analysis of Variance.

5.3.0 Implications of the Findings
The data analyses in chapter four, gave several findings of the study. These findings are discussed under this section with reference to each hypothesis.

5.3.1 Difference in Performance between Students Taught Through Jigsaw Technique of Cooperative Learning and Those Taught Through the Traditional Lecture Method.

According to the results obtained in the analysis there was a statistically significant difference between students taught through Jigsaw Technique of Cooperative Learning and those taught through the traditional Lecture Method. This implied that experimental group students who were taught through jigsaw technique of cooperative learning scored higher marks in the Geography test than the control group students who were taught through the traditional lecture method. These findings are consistent with results in a number of studies done on Jigsaw Technique of Cooperative Learning. For instance, according to Lazarowitz and others (1985), a number of studies have shown that the
Jigsaw method leads to higher achievement in biology, and increased positive attitudes and interest in the material studied (Van Voorhis, 1995). These research studies have shown that the jigsaw cooperative learning enhances cooperation by making each student responsible for teaching some of the material to the group.

Indeed, unlike learning situations which foster competitiveness or individualistic efforts, a cooperative learning situation has been found by Kagan (1992) and Slavin (1991) to result in higher achievement and greater productivity, more energy, supportive and committed relationships, greater psychological health, social competence and high esteem. Students who collaborate on their studies develop a great deal of commitment and caring for each other. They have positive attitudes towards their teacher, and perceive the teacher as being more supportive and caring for their academic advancement. Eventually, cooperative learning increases students’ ability to think creatively because their ideas are increased, and so is the quality of these ideas, they enjoy and are stimulated. Students appreciate their group members’ ideas instead of ignoring or trying to outshine them.

5.3.2 Difference in Performance between Pretest and Posttest Measures in Students Taught Through Jigsaw Technique of Cooperative Learning.

The results of analysis indicated that there was a statistically significant difference in geography test scores between the pretest and posttest measures in the experimental group, that is, the students taught through jigsaw technique of cooperative learning. This implied that the experimental group students after being subjected to the jigsaw technique of cooperative learning scored high marks in the geography test in the posttest than in the
pretest before being subjected to the jigsaw technique of cooperative learning, where they scored low scores in the same test. This hypothesis was formulated in order to further ascertain the influence of the jigsaw technique of cooperative learning. The findings thus affirmed those in Ho₁, in which the treatment (i.e. the jigsaw technique of cooperative learning) had a positive influence on performance in the geography test. Therefore, it follows that the findings in Ho₂ agrees with those of studies reviewed with regard to Ho₁, that is, Lazarowitz and others (1985), Van Voorhis (1995), Kagan (1992) and Slavin (1991).

5.3.3 Difference in Performance between the Low Vision and the Blind Students Taught Through Jigsaw Technique of Cooperative Learning.

The results of analysis showed that there was no statistical significance difference in geography test scores between the low vision and blind students taught through jigsaw technique of cooperative learning. This implied that regardless of their differences in the levels of vision, students using the jigsaw technique of cooperative learning performed more or less the same in the geography test given. Indeed, most of this research shows that cooperative learning is more effective for groups of learners than is traditional learning. Johnson, Johnson, Holobee, & Roy (1984) show that nothing succeeds like success.

They report 122 studies comparing cooperative to competitive and individualistic learning and claim gains in critical thinking, content attitudes, psychological health, peer acceptance, self acceptance, willingness to help others, collaboration ability, positive teacher perceptions and ability to see another’s point of view. Johnson (1988) reports data
which indicates that the quality and quantity of learning in a variety of areas, for instance, problem solving, concept attainment among others, are improved by placing the learners in a cooperative rather than a competitive or individualistic learning setting. Thus, it is of no doubt to find that children taught under co-operative learning would regardless of their level of vision perform more or less the same in a given test.

5.3.4 Difference in Performance between the Male and the Female Students Taught Through Jigsaw Technique of Cooperative Learning.

The analysis of this hypothesis indicated that there was no statistically significant difference in geography test scores between male and female students after being taught through jigsaw technique of cooperative learning. This implied that regardless of whether one was a male or a female, his/her performance in the geography test given was more or less the same as the rest after being taught by the jigsaw technique of cooperative learning. These results give evidence to the fact that cooperative learning provides for motivation by providing social support and encouragement.

In cooperative learning, learners are accountable to their peers for practice and accomplishment. Students receive interpersonal feedback as to the quality of their production based on peer negotiated criteria. Each participant shares mental models, which are used to jointly solve problems. Conceptual understanding is constructed and extended through exploration and discussion. Most are in the social interactive process. In this way, information is transformed into knowledge and the social fabric of the culture is passed from one generation of learners to another. As learners are integrated
into the group they establish, through practice, a shared identity with other group members.

5.3.5. Difference in Performance between Students Using Braille and Those Using Print as Medium of Instruction after Being Taught Through Jigsaw Technique of Cooperative Learning

According to the analysis of this hypothesis, there was no statistically significant difference in geography test scores between students using Braille and those using print as a medium of instruction. This implied that whether one used Braille or print as a medium of instruction, it did not influence his/her performance in the geography test given after being taught by the jigsaw technique of cooperative learning. Because in such a co-operational or rather collaborative settings, the learner negotiates for learning tasks that fit his/her needs, regardless of whether he/she uses Braille or print as a medium of instruction. (http://ksi.cpsc.ucalgary.ca/articles/LearnWeb/EM97WP/EM97-WP.html)

Learners dialogue with others, with the content author (teacher), and with the materials and expand on or adapt the materials to build cognitive structures and to extend their discourse histories. What is implied here is that when questions are asked in a cooperative setting, individuals, with teacher assistance to start with, can seek information to answer the questions. Teachers will try to make the implicit explicit, show strategies that differentiate the novice from the expert, and show learners how to find appropriate resources. When the student controls the searching, instruction supports construction. In constructivist environments, learners should be allowed to negotiate for
tasks both individually and by team. The teacher may provide a list of tasks or an outline of what tasks should focus on and the learners should be free to negotiate to modify the tasks to meet their individual needs. The more negotiation is allowed the more the students will feel ownership for the project and the higher the level of motivation that they will exhibit. Negotiation needs to be built into the instructional design to legitimate its use with students.

5.4 Conclusions

Overall, the results of the study have evidently showed that if students are taught through jigsaw technique of cooperative learning they will perform better than those taught through the traditional lecture method. Hence, it is a method worth being emphasized in learning institutions for the visually impaired so as to increase their mastery of knowledge and skills. This is because regardless of gender and type of instructional medium, be it Braille or print, the method is still effective as there are no statistically significant differences on such basis.

5.5 Recommendations

Policy makers, educational planners, curriculum developers and teachers in the schools for the visually impaired are hereby recommended to emphasize and adopt the use of the jigsaw technique of co-operational learning in order to motivate and improve acquisition of knowledge and skills in learners with visual impairment. There is evidence all over the world that many learners do not achieve to their potential because they find learning to be ‘boring’. Kenya Institute of Education (KIE) and Kenya National Examination Council
(KNEC) should focus on a capacity building curriculum, enriched with a large differentiated repertoire of teaching strategies and assessment systems catering for individual needs of learners in an inclusive setting, since many children drop out of school or are ‘pushed out’ due to uninteresting teaching methodology and assessment systems that label them as poor achievers.

Policy makers, educational planners and the Teachers Service commission should encourage teachers to benefit from continuous in service and refresher courses for professional development that will make them learning friendly teachers who have a clear vision, open to changes, motivated, creative, flexible and open to participation in training and workshops, committed and sensitive, love children, create good rapport, respect diversity and are able to work as a team.

Teachers to create a child friendly learning environment, through instructional settings that promote a high degree of involvement with other learners, in order to support the students’ sense of responsibility for their own learning, by providing opportunities for autonomy, independence and critical thinking, as well as participating in decision making in the classroom and in the school.

5.6 Further Research

Further research is recommended in respect to this method of instruction on other students in programs for the visually impaired and in an inclusive setting, so as to increase the validity and reliability of the technique by providing regional comparison.
REFERENCES


http://ksi.cpsc.ucalgary.ca/articles/LearnWeb/EM97WP/EM97-WP.html

http://www.jigsaw.org

http://jigsawhelper.org

67
http://vesid.nysed.gov/lsn


http://ksi.cpsc.ucalgary.ca/articles/learnWeb/EM97WP/EM97-WP.html


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Roger, T. J. & David, W. J. (1996). The Role of Cooperative Learning Assessing and 
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Learning in the Classroom: In Sharan, S. Hare, P. Webb, C. D.

Hertz-Lazarowitz R. Cooperation in Education. Provo. Utah: Brigham 
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Dear Hellen,

Thank you very much for your inquiry. If you haven't already done so, please look at my web site: www.jigsaw.org. There is also an excellent web site of curricular materials that some teachers have developed: www.jigsawhelper.org.

It is particularly interesting to me that you are applying this technique in a school for the blind.....because, for the past 4 years, I have been afflicted with macular degeneration....and I am now legally blind and can barely read large print with a great deal of magnification. So I have a great deal of empathy for the situation you are dealing with. I would suggest that you try to adapt jigsaw to auditory materials like tape recordings, assigning each student one paragraph of a biography for example.

I wish you the best of luck. Please keep me informed as to your progress.

Cordially,

Elliot Aronson
Distinguished Visiting Professor
Stanford University
# APPENDIX B
## SCHEMES OF WORK
### CLASS: FORM 2W  SUBJECT: GEOGRAPHY

<table>
<thead>
<tr>
<th>Week</th>
<th>Lesson</th>
<th>Topic/Sub Topic</th>
<th>Objectives</th>
<th>Teachers Activities</th>
<th>Learners Activities</th>
<th>Teaching/Learning Resources</th>
<th>Reference</th>
<th>Assessment</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Topic: Rocks</td>
<td>By the end of the lesson, the learner should be able to: i) Define the term mineral ii) List the main elements of the earth’s crust iii) Explain the characteristics of minerals</td>
<td>- Breaks the lesson into manageable tasks for each Jigsaw “home” group and explains what is expected. - Issues reference materials to each learner depending on the mode of reading. - Releases the learners to the expert groups for</td>
<td>- Listen carefully and note the major points. - Receives the reference materials. - Research and discuss on their segments</td>
<td>A chart showing the elements of the earth crust</td>
<td>Kisovi, M.L.(2003). Explore Geography. Longhorn Kenya. Karuggah, R. &amp; Kibuuka, P. (2003). Certificate Geography. Oxford University Press. Kenya. KLB.</td>
<td>Oral questions.</td>
<td></td>
</tr>
</tbody>
</table>
| 2 | **Topic:** Rocks.  
**Sub – Topic:** Classification | By the end of the lesson, the learner should be able to:  
  i) Define Rocks.  
  ii) List the classes of rocks.  
  iii) Explain how intrusive igneous rocks are formed. | - Guides learners on the task in their Jigsaw "expert" groups, and issues learning resources.  
- Moves from group to group. | - Note down the main points and share the resources.  
- Different types of rocks.  
- Discusses on their | - Different types of rocks.  
- A chart showing classes of rocks according to origin.  
KCSE Revision Geography,  
KLB, Kenya.  
The Earth Science: |
| 3 | **Topic:** Rocks.  
**Sub – Topic:** Classification. | By the end of the lesson, the learner should be able to:  
1. Explain how Intrusive rocks are formed.  
2. Give examples of extrusive rocks. | - Issues learners with resources/materials in their Jigsaw “home” groups, explains the task and release them.  
to their Jigsaw "expert" groups.

- Moves from group to group solving and problems and making clarifications.

- Asks the learners to move back to their Jigsaw "home" groups for presentations.

- Gives an assignment on observation of types of intrusive rocks within the school compound.

- Discusses on their segments, makes notes and seeks clarification and guidance from the teacher.

- Make their presentations in their Jigsaw "home" groups.

- To carry out the assignment.

KLB. (2002).
KCSE Revision Geography.
KLB, Kenya.


<table>
<thead>
<tr>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Topic:</strong> Rocks.</td>
<td>By the end of the lesson, the learner should be able to: i) Explain how sedimentary rocks are formed. ii) Name the classification of sedimentary rocks.</td>
</tr>
<tr>
<td><strong>Sub Topic:</strong> Sedimentary rocks</td>
<td>- Asks questions on observations made about intrusive rocks within the school compound. - Explains the task, issues learning materials and resources. - Clarify the points raised by learners in their Jigsaw &quot;expert&quot; groups. - Ask learners to move to their Jigsaw &quot;home&quot; groups and make their presentations and moves.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Answers orally. - Researches and notes down major points. - Discuss and take notes. - Make presentations to their groups.</td>
</tr>
<tr>
<td></td>
<td>A chart showing the classification of sedimentary rocks. KLB. (2002). KCSE Revision Geography. KLB, Kenya</td>
</tr>
<tr>
<td></td>
<td>Oral questions</td>
</tr>
</tbody>
</table>
| 3 | **Topic:** Rocks.  
**Sub Topic:** Chemically formed sedimentary rocks. | By the end of the lesson, the learner should be able to:  
i) Explain how sedimentary rocks are formed chemically.  
ii) List and explain the classes of chemically formed rocks. | - Asks learners to explain how sedimentary rocks are formed generally.  
  - Explains how sedimentary rocks are formed chemically. | - Make presentations, and take notes.  
  - Studies the chart and answers questions orally. | A chart showing classes of chemically formed sedimentary rocks.  
Samples of types of sedimentary rocks. | Oral questions  
<table>
<thead>
<tr>
<th>Formed sedimentary rocks.</th>
<th>Issues them with reference materials/resources and assignments to discuss in their Jigsaw &quot;expert&quot; groups and make presentations in their Jigsaw &quot;home&quot; groups on the classification of chemically formed sedimentary rocks.</th>
<th>Discuss and make presentation while at the same time they take notes.</th>
<th>Explore Geography. Longhorn Kenya. KLB. (2002). KCSE Revision Geography. KLB, Kenya.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Give a written assignment to be done by the Jigsaw &quot;expert&quot; groups and present their answers.</td>
<td>- Do the assignment and present their answers and make corrections.</td>
<td></td>
</tr>
</tbody>
</table>
| Topic: Rocks.  
Sub Topic: Metamorphic rocks/age of rocks | By the end of the lesson, the learner should be able to: 

i) Define metamorphic rocks. 
ii) Explain how metamorphic rocks are formed. 
iii) Name types of metamorphic rocks. 
iv) Explain the methods used in estimating the age of rocks. | - Define metamorphic rocks. 
- Issue resource/reference materials, assign learners segments of assignments to be done in Jigsaw groups. 
- Move from group to group making necessary interventions. | - Ask questions and note the definition. 
- Research on the given assignments, discuss and take notes in Jigsaw “expert” groups. | A chart showing methods used in dating rocks. 
<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
</table>
| 2 | **Topic:** Rocks.  
**Sub Topic:** Distribution of major rocks in Kenya. | By the end of the lesson, the learner should be able to:  
i) Explain how different rocks are distributed in Kenya according to geographical regions. | - Guide learners to identify geographical region of Kenya.  
- Issue reference/learning resource materials to the learners and assigns learning tasks to the learners to discuss in their Jigsaw “expert” groups.  
- Supervises the assignments, and clarifies issues arising. | - Identify geographical regions.  
- Discuss their assignments and makes presentations in their Jigsaw “home” groups.  
- Raise issues to be clarified and take notes. | A chart showing the distribution of major rocks in Kenya.  
Explore Geography. Longhorn Kenya.  
Comprehensive Geography. Longhorn Publishers. Nairobi  
KLB. (2002).  
KCSE Revision Geography. KLB, Kenya.  
Oral questions |
<table>
<thead>
<tr>
<th></th>
<th>Post - Test</th>
<th>By the end of the lesson, the learner should be able to attempt all the questions with at least 60% accuracy.</th>
<th>- Administer the Post Test based on the content covered</th>
<th>- Attempt the teacher made test.</th>
<th>Question Papers in print, Braille and large print.</th>
<th>Written test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week</td>
<td>Lesson</td>
<td>Topic/Sub Topic</td>
<td>Objectives</td>
<td>Teachers Activities</td>
<td>Learners Activities</td>
<td>Teaching/Learning Resources</td>
</tr>
<tr>
<td>------</td>
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<td>--------------------------</td>
</tr>
</tbody>
</table>
| 2 | **Topic:** Rocks.  
**Sub – Topic:** Classification | By the end of the lesson, the learner should be able to:  
i) Define Rocks.  
ii) List the classes of rocks.  
iii) Explain how intrusive igneous rocks | - Gives types of rocks to learners to make an observation through touch, sight, feel, or smell.  
- Ask the learners to orally define a | - Learners make their observation as appropriate.  
- Give an oral definition of | - Different types of rocks.  
- A chart showing classes of rocks according to origin.  
- KCLE Revision Geography, KLB, Kenya. Pg 95-96.  
<table>
<thead>
<tr>
<th>Topic: Rocks.</th>
<th>By the end of the lesson, the learner should be able to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Explain how intrusive</td>
<td>ii) Explain how extrusive</td>
</tr>
</tbody>
</table>

- Clarifies the definition and lead learners to tell the differences and similarities between the types of rocks given to them.
- Explains how intrusive igneous rocks are formed.
- Takes note of the definition and states the differences and similarities.
- Listens and take notes

- Asks oral questions on the difference between intrusive and extrusive
- Orally explain the differences.

Pictorial and tactile presentations/diagram on formation of extrusive rocks

rocks are rocks. Kenya. Pg 126.


rocks. examples of rocks. KCSE Revision.

- Makes short notes and ask learners to fill in the gaps.

- Take the notes filling in the gaps.

- Make an assignment to observation learners to fill the gaps.

- Take notes and ask learners to fill in the gaps.

- Make an observation on types of rocks within the school compound.

- Give an assignment to observation

- Give an assignment to observation

- Give examples of extrusive rocks.

- Give examples of extrusive rocks.

- Give examples of extrusive rocks.
| 2 | 1 | **Topic:** Rocks.  
**Sub Topic:** Sedimentary rocks | **By the end of the lesson, the learner should be able to:**  
i) Explain how sedimentary rocks are formed.  
ii) Name the classification of sedimentary rocks. | **- Asks questions on observations made about intrusive rocks within the school compound.**  
**- Listens and takes down notes.** | **- Answers orally.**  
**- State the clarification and take notes.** | **A chart showing the classification of sedimentary rocks.** | KLB. (2002).  
KCSE Revision Geography, KLB, Kenya  
The Earth Science: The world we live in.  
Certificate Geography, Oxford University | **Oral questions** |
|---|---|-------|---|---------------|
| 2 | **Topic:** Rocks.  
**Sub Topic:** Mechanically formed sedimentary rocks | By the end of the lesson, the learner should be able to:  
i) Explain how sedimentary rocks are formed mechanically.  
ii) List classes of sedimentary rocks based on sizes of constituent particles, composition of the material and mode of formation. | - Explain how sedimentary rocks are formed mechanically.  
- Guide learners to list classes of mechanically formed sedimentary rocks in groups based on size of their constituent particles, composition of the material and mode of formation.  
- Dictate notes | - Listen and take notes.  
- List the classification of mechanically formed sedimentary rocks.  
- Take notes. | A chart showing the classification of mechanically formed sedimentary rocks.  
Oral questions |
| 3 | **Topic:** Rocks.  
**Sub Topic:** Chemically formed sedimentary rocks. | By the end of the lesson, the learner should be able to:  
i) Explain how sedimentary rocks are formed chemically.  
ii) List and explain the classes of chemically formed sedimentary rocks. | - Explains how sedimentary rocks are chemically formed.  
- Lists, asks questions for clarification and take notes.  
- Listen asks questions for clarification and takes notes.  
- Study the chart and take dictation.  
- Refers the learners to the chart on classes of chemically formed sedimentary rocks. | A chart showing classes of chemically formed sedimentary rocks.  
Samples of types of sedimentary rocks | Oral questions | KLB. (2002).  
KCSE Revision Geograph y. KLB, Kenya.  
KLB, Kenya.  
Explore Geograph y. Longhorn Kenya. |
| 3 | 1 | **Topic:** Rocks.  
**Sub Topic:** Metamorphic rocks/age of rocks | By the end of the lesson, the learner should be able to:  
- Define and explains how metamorphic rocks are formed.  
- Guide learners to state types of metamorphic rocks.  
- Explains the method used in estimating the age of rocks.  
- Listen, ask questions for clarification and take notes.  
- States types of metamorphic rocks and take notes.  
Karuggah, R. & |
<table>
<thead>
<tr>
<th>Topic: Rocks.</th>
<th>By the end of the lesson, the learner should be able to:</th>
<th>- Guide learners to identify geographical regions of Kenya.</th>
<th>A chart showing the distribution of major rocks in Kenya.</th>
<th>Oral questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub Topic: Distribution of major rocks in Kenya.</td>
<td>- Identify geographical regions.</td>
<td>- Raise issues to be clarified and take notes.</td>
<td>An Atlas</td>
<td></td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>Post - Test</td>
<td>By the end of the lesson, the learner should be able to attempt all the questions with at least 60% accuracy.</td>
<td>- Administer the Post Test based on the content covered</td>
<td>- Attempt the teacher made test.</td>
</tr>
</tbody>
</table>
# LESSON PLAN: EXPERIMENTAL GROUP.

**School:** Thika High School for the Blind.

**Subject:** Geography

**Date:** 11/9/06  
**Time:** 8.00 am – 8.40 am

**Form:** 2W  
**No. of learners:** 20

**Topic:** Rocks

**Sub Topic:** Minerals

**Schemes of Work Reference:** Week 1: Lesson: 1

**Specific Objectives:** By the end of the lesson, the learner should be able to:

- Define the term mineral
- List the main elements of the earth’s crust
- Explain the characteristics of minerals

**Reference:**


**Teaching Learning /Resources:** A chart showing the elements of the earth crust.

## LESSON DEVELOPMENT

<table>
<thead>
<tr>
<th>Step/ Duration</th>
<th>Teacher’s Activities</th>
<th>Learner’s Activities</th>
</tr>
</thead>
</table>
| **Introduction.**  
(3 minutes)      | - Explains the Jigsaw Technique and group tasks. | - Ask questions for clarification and notes important points. |
| **Step 1.**  
(8 minutes)      | - Uses simple random sampling to place learners in Jigsaw “home” groups, shares segments for discussion, issues learning resources/materials and | - Forms Jigsaw “home” groups, shares learning resources/materials, break into Jigsaw “expert” groups. |
<table>
<thead>
<tr>
<th>Step 2</th>
<th>Step 3</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>(12 minutes)</td>
<td>(10 minutes)</td>
<td>(7 minutes)</td>
</tr>
</tbody>
</table>

- Releases the learners to form Jigsaw “expert” groups for exploration.
- Moves from one group to another supervising and making interventions.
- Calls for learners to return to Jigsaw “home” groups for presentation.
- Research and discuss on their segments as they make notes and ask questions for clarification.
- Makes their presentations and elaborates their segments to the members.
- Gives a general summary and assignments.
- Ask questions for clarification and note down important points.

**Chalkboard Layout**

<table>
<thead>
<tr>
<th>Class: Form 2w</th>
<th>Geography: Minerals</th>
<th>Date: 11/9/2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Definition of a mineral</td>
<td>- Main elements of the earth crust</td>
<td>- Characteristics of minerals</td>
</tr>
</tbody>
</table>

**Self Evaluation:**

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LESSON PLAN: CONTROL GROUP.

School: Thika High School for the Blind.
Subject: Geography  Date: 11/9/06  Time: 8.00 am – 8.40 am
Form: 2S  No. of learners: 20
Topic: Rocks
Sub Topic: Minerals

Schemes of Work Reference: Week 1: Lesson: 1

Specific Objectives: By the end of the lesson, the learner should be able to:

- Define the term mineral
- List the main elements of the earth’s crust
- Explain the characteristics of minerals

Reference:

Teaching Learning /Resources: A chart showing the elements of the earth crust.

LESSON DEVELOPMENT

<table>
<thead>
<tr>
<th>Step/ Duration</th>
<th>Teacher’s Activities</th>
<th>Learner’s Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction.</td>
<td>- Asks oral questions about the definition of rocks.</td>
<td>- Answer oral questions.</td>
</tr>
<tr>
<td>( 5 minutes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 1.</td>
<td>- Defines the term mineral.</td>
<td>- Listens and seeks clarification where necessary.</td>
</tr>
<tr>
<td>( 7 minutes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>- Guide learners to state the elements of the earth crust.</td>
<td>- States the elements of the earth crust.</td>
</tr>
<tr>
<td>(7 minutes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>- Guide learners to list and explain the characteristics of minerals.</td>
<td>- States and explains the characteristics of minerals.</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Step 4 (6 minutes)</td>
<td>- Dictates notes about minerals for learners.</td>
<td>- Copy the notes.</td>
</tr>
<tr>
<td>Conclusion (5 minutes)</td>
<td>Gives a general summary and assignments.</td>
<td>Ask questions for clarification and notes down important points.</td>
</tr>
</tbody>
</table>

**Chalkboard Layout**

<table>
<thead>
<tr>
<th>Class: Form 2w</th>
<th>Geography: Minerals</th>
<th>Date: 11/9/2006</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Definition of a mineral</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Main elements of the earth crust</td>
<td></td>
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<td>- Characteristics of minerals</td>
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**Self Evaluation:**

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Appendix F

GEOGRAPHY EXAM: FORM 2
Instruction: Answer all the questions.

Section A:
1). Define the following,
   i) A mineral.
   ii). A rock.
   iii). An ore

2). List any three general ways through which the rocks of the crust originated and are classified.

3). List any three geological events in the history of the earth.

4). Classify the following rocks;
   i). Quartzite
   ii) Marble
   iii). Granite
   iv). Limestone
5). Fill in the gaps in the following sentences about the uses of minerals.
   i). ------------------ is used in the steel industry.
   ii). --------------- is used for making jewellery and currency.
   iii). ----------- is used for manufacture of electric cables, pipes and coins.
   iv). ----------- the hardest substance known.

(8 marks)

6). List three eras of the last 600 million years.
   a). -------------------------------------------------------------
   b). -------------------------------------------------------------
   c). -------------------------------------------------------------

(3 marks)

7). The ability of minerals to allow light to pass through can be described in three ways,
   i). -------------------------------
   ii). ---------------------------------
   iii). ----------------------------------

(3 marks)

SECTION B:
Instructions: Answer all the questions in this section.

1). Discuss the different characteristics of minerals. Cite relevant examples for each category. (25 marks)

2). Discuss citing examples, the economic significance of rocks to man.
(25 marks)

----------------------------------------------------------- END -----------------------------------------------------------
GEOGRAPHY EXAM: MARKING SCHEME: FORM 2

Section A:
1). i) Definition of a mineral.
- Organic or non-living/inorganic solid substances
- Occur naturally at or beneath the surface of the earth.
- Have specific physical and chemical properties.
   (3 x 2 = 6 marks)

ii). Definition of a rock.
- Inorganic solid materials
- Made up of a mixture of different minerals
- Found in the interior and exterior parts of the earth.
- Occur naturally at or beneath the surface of the earth.
   (4 x 2 = 8 marks)

iii). Definition of an ore
- A rock containing metallic compounds in large quantities that can be exploited on a commercial scale.
   (2 marks)

2). Three general ways through which the rocks of the crust originated and are classified,
   i) Igneous – Formed when molten magma from the interior of the earth cools and solidifies in the crust on the surface of the earth.
   ii) Sedimentary – Formed from the deposits of sediments or particles of other rocks which are laid down in layers either on land or in water.
   iii) Metamorphic – They are sedimentary or igneous rocks that have been subjected to great heat or pressure hence they are changed in appearance physically or in character chemically.
   (3 x 2 = 6 marks)

3). Three geological events in the history of the earth.
   - Rift formation
   - Faulting processes
   - Mountain building
   - Volcanic eruptions
   - Ice accumulation on global scale
   - Evolution and extinction of certain species
   (3 x 2 = 6 marks)

4). Classifying rocks;
   i). Quartzite -------- Metamorphic
ii) Marble ------- Metamorphic  
iii). Granite ------ Igneous  
iv). Limestone ----- Sedimentary  

(4 x2 = 8 marks)

5). Filling gaps in the following sentences about the uses of minerals.  
i). Manganese is used in the steel industry.  
ii). Gold is used for making jewellery and currency.  
iii). Copper is used for manufacture of electric cables, pipes and coins.  
iv). Diamond is the hardest substance known.  

(2 x 4 = 8 marks)

6). Three eras of the last 600 million years.  
a). - Paleozoic  
b). - Mesozoic  
c). - Cenozoic  

(3 x 1 = 3 marks)

7). The ability of minerals to allow light to pass through can be described in three ways.  
i). - Opaque  
ii). - Translucent  
iii). - Transparent  

(3 x1 = 3 marks)

SECTION B:

1). Different characteristics of minerals, citing relevant examples/.  
i) Characteristics  
- different degree of hardness  
- aggregate into distinct shapes  
- some have only one element/or more  
- can be opaque/ translucent/transparent  
- different texture  
- specific colours  
- luster – surface appearance as it reflects on light  

(7 x 2 = 14 marks)

ii) Examples  
- Tenacity- ability to withstand tearing, crushing/breaking.  

(2 x 1= 2 marks)  
- Brittle  
- Elastic  
- Ductile/flexible  

(3 x 1 = 3 marks)
- Cleavage- tendency to break along certain lines
- Differ in streak – color left after it’s rubbed on a surface.

(2 x 3 = 6 marks)

2). The economic significance of rocks to man.
- Tourists attraction
- Building materials
- Underground water storage
- Cement for construction
- Valuable minerals
- Source of fuel – cool
- Soil for agriculture
- Salts
- Chemicals for dyes, fertilizers and medicine.

(Any 5 x 5 = 25 marks)
Appendix H:

Raw Scores in Geography Test.

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Dear Madam

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on, 'Effects of the Jigsaw Technique on Performance of Visually Impaired Geography Students in Thika High School'

I am pleased to inform you that you have been authorized to carry out research in Thika District for a period ending 30th April 2007.

You are advised to report to the District Commissioner and District Education Officer Thika District before embarking on your research project.

On completion of your research, you are expected to submit two copies of your research report to this office.

Yours faithfully

[Signature]

B. O. ADEWA
FOR: PERMANENT SECRETARY

Copy to:

The District Commissioner
Thika District

The District Education Officer
Thika District